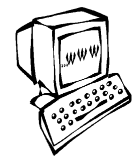
Region One
Vegetation Classification, Mapping, Inventory and Analysis Report



$$\bar{x} = \frac{\sum x}{n}$$

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Estimates of Snag Densities For Northern Idaho Forests in the Northern Region

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1.0 Introduction

The Northern Region (Region 1, R1) has decided to replace the Northern Region Snag Management Protocol, developed in 2000. These protocols provided optional snag retention standards based on FIA data from western Montana forests. However, the Protocol specifically recognized that FIA data from northern Idaho and eastern Montana was not used in the development of the 2000 Protocol, as it was not available at the time. FIA data is now available for all of Region 1. Furthermore, because of better analysis capabilities and recent research in snag densities, the Region has decided to replace the 2000 Snag protocol with new analysis, using consistent methodologies, across the Region. This report provides a replacement for the Northern Region Snag Protocol for northern Idaho Forests in Region 1. The snag information provided in this paper does not set forth mandatory or required direction but rather provides snag information for consideration by the Forests. This information is displayed for project level consideration in Table 12.

This report was edited 12/23/09 to correctly show that Appendix C, Table 2b is displaying live trees per acre, not snags per acre.

Analysis for snag densities was performed by geographic area: northern Idaho comprised of the Idaho Panhandle, Nez Perce, and Clearwater National Forests; western Montana comprised of the Kootenai, Flathead, Lolo, and Bitterroot National Forests; and eastern Montana comprised of the Beaverhead-Deerlodge, Custer, Gallatin, Helena, and Lewis and Clark National Forests. Table 1 shows snags per acre across the entire land base between the three geographic areas. There is a statistically significant difference in the density of snags and large-live trees between

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these areas due to biophysical and climatic differences between the areas. This suggests that snag analysis and management plans pertaining to snags should be formulated by geographic area and not extrapolated from one area to another.

Table 1: Estimates of snag and live tree densities and associated 90% confidence intervals, by diameter class, for eastern Montana, western Montana, and northern Idaho Forests in Region 1.

Area	Snags per Acre 15"+			Snags per Acre 20"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Eastern Montana	2.2	1.9	2.5	0.5	0.4	0.6	11.2	10.4	12.1	2.7	2.4	3.0	1475	1175
Western Montana	2.9	2.6	3.2	0.9	0.8	1.1	14.8	13.9	15.6	4.6	4.3	5.0	1351	1243
North Idaho	4.0	3.6	4.4	1.6	1.4	1.8	21.3	20.1	22.5	7.8	7.2	8.4	1057	1005

Region 1 completed this analysis related to snag densities for planning purposes and project-level retention and recruitment options for consideration, for Forests on the northern Idaho portion of the Region: the Idaho Panhandle National Forests, the Clearwater National Forest and the Nez Perce National Forest. It used Forest Inventory and Analysis (FIA) data to explore the density and distribution of snags within and outside of wilderness/roadless areas, by habitat type groups, dominance groups, and seral stages. This analysis took into consideration recent findings on the effect that timber harvest and human access have on snag density; how snag density relates to stand succession and disturbances; and the spatial pattern of snags.

The results of this analysis will enable the northern Idaho forests of Region 1 to monitor snags over time at the broad-level and adaptively manage project-level considerations, as snag densities change over time.

2.0 Methods

2.1 Overview of data used in this analysis

Forest Inventory and Analysis (FIA) data were used to explore the distribution of snags on Forests throughout Region 1. Using FIA data to assess the density of snags allows for regional monitoring based on an unbiased, representative sample of forest lands subject to regular remeasurement. Many attributes are measured on an FIA plot, including habitat type and incidence of snags and their diameter at breast height (DBH). For an overview of FIA data in general and why it is appropriate to use in this analysis, see Appendix A.

The FIA sampling frame uniformly covers all forested lands, regardless of management emphasis; thus, wilderness and roadless areas, as well as actively managed lands, have equivalent sampling probabilities. As a result, spatial data sets can be intersected with FIA plot locations to estimate snag density for specified geographic areas.

A spatial layer of roadless and wilderness areas was created using a coverage from the 2001 Roadless Final Rule available from http://fs.usda.gov/internet/FSE_DOCUMENTS/fsm8_036225.zip . This spatial dataset was intersected with the FIA plots in order to determine which plots were within wilderness/roadless areas and which plots were outside.

2.2 Output displayed in tables
Estimates of mean snag density from FIA data are displayed with their respective 90% confidence intervals, which provide an indication of the reliability of the estimate. At a confidence level of 90%, unless a 1 in 10 chance has occurred, the true population mean is within this interval. Average densities per acre are shown for diameter classes: 10.0" DBH and larger, 15.0" DBH and larger, and 20.0" DBH and larger. It should be noted that these three classes are not mutually exclusive, all snags15.0" DBH and larger are included in the estimate of snags 10.0" DBH and larger, and all snags 20.0" DBH and larger are included in the estimate of snags 15.0" DBH and larger.

The total primary sampling units (PSUs) are the number of FIA plots within the domain of interest, such as wilderness/roadless or with a specified dominance group. The number of forested PSUs is the number of FIA grid locations that have at least a portion of the PSU with a "forested" condition. The information from the "forested" portion of the PSUs is used in this analysis.

3.0 Preliminary analysis of snag densities on northern Idaho Forests

We evaluated snag densities on the northern Idaho Forests of Region 1 using a hierarchical approach.

3.1 Comparison of Snag Density within and outside of Wilderness and Roadless Areas
First, we looked at the density of snags within and outside of wilderness and roadless areas. Timber harvest and human access can have substantial effects on snag density and longevity (Wisdom and Bate, 2008; Russell et al. 2006). Exploring the density of snags in wilderness and roadless areas can provide insight to natural snag abundance and distribution on a Forest. These can be compared to paired field plots outside wilderness/roadless to help to understand differences between areas that have been influenced by management and unmanaged areas. There is some uncertainty how climate, a period of cool and moderate precipitation, and fire suppression from 1930-1985 has affected snag density and distribution in wilderness and roadless areas. Harris (1999) notes similar uncertainty concerning effects of fire suppression on creation of snags in unharvested areas of western Montana. However, even with some degree of uncertainty it is the best quantitative data available to represent natural forested systems. To date, there has been no known extirpation of cavity nesting species from northern Idaho Forests, within or outside of roaded areas. It follows that, in general, analysis of the roadless portion of these Forests will represent an appropriate range of snag numbers and distribution to develop desired snag conditions for planning purposes.

As shown by Table 2, there are slightly more snags in many of the diameter classes outside of wilderness and roadless areas for the northern Idaho area in general, as well as for the IPNF and Clearwater NF. Due to the magnitude of the 1910, 1919, 1926, and 1931 fires, which are now in the mid seral class of succession, and are primarily roadless, these areas might have fewer snags compared to other lands that have not been impacted by the magnitude of such fires. However, upon comparing the confidence interval for these snag classes, we found that the differences in the estimates are not statistically significant. Furthermore, the larger the snag, the less common it is. This is largely due to less trees living to an older age, as trees age, they grow slower, never reaching very-large diameters, and the inability of systems to contain large old trees and snags due to various types of disturbance agents which kill and remove them over time.

Table 2: Mean snag densities per acre with 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas for all northern Idaho Forests and for each Forest.

Area	Wilderness / Roadless	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
North Idaho	IN	10.3	9.3	11.4	3.9	3.4	4.4	1.6	1.4	1.9	514	514
Idaho Panhandle		10.4	8.4	12.6	3.7	2.8	4.7	1.6	1.1	2.1	133	133
Clearwater		8.9	7.3	10.5	3.7	2.9	4.5	1.6	1.2	2.1	189	189
NezPerce		11.7	9.9	13.7	4.2	3.3	5.2	1.7	1.3	2.1	192	192
North Idaho	OUT	11.7	10.5	12.9	4.3	3.7	4.9	1.6	1.4	1.9	478	478
Idaho Panhandle		12.7	11.1	14.5	4.2	3.5	4.9	1.4	1.1	1.7	260	260
Clearwater		9.6	7.5	11.9	4.4	3.3	5.7	2.1	1.4	2.8	106	106
NezPerce		11.2	8.6	14.0	4.3	3.0	5.9	1.8	1.2	2.4	112	112

3.2 Estimates of Snag Density by Habitat Type Groups

Second, estimates of large-snag density, by aggregations of habitat types (Pfister, 1977), (Cooper and others, 1991), referred to as habitat type groups, described in *Biophysical Classification – Habitat Type Groups and Descriptions of Northern Idaho and Northwestern Montana, Lower Clark Fork and Adjacent Areas* (USDA Forest Service, Northern Region, 2005) and commonly used for northern Idaho and western Montana vegetation assessments were derived (Table 3). The habitat types by biophysical group are shown in Appendix B. These habitat type groupings are based on similarities in natural disturbance regimes, successional patterns, and structural characteristics of mature stands, which determine snag abundance ranges during various stages of succession. Habitat type groups were used instead of Vegetative Response Units (VRUs) because habitat type groups are a consistent classification system utilized across all northern Idaho and western Montana Forests for planning and analysis.

Habitat type groups with similar fire ecology groups (Fischer and Bradley, 1987) are shaded in table 3. Individual Forest's snag densities, by these habitat type groups are displayed in Appendix C, Table 1.

Table 3: Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all northern Idaho Forests.

Area	Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total # PSUs	# Forested PSUs
		Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90% CI Upper Bound		
In Wilderness/Roadless	Cold	2.3	0.3	4.5	2.3	0.3	4.5	2.3	0.3	4.5	3	3
	Cold & Mod Dry	7.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	6	6
	Cool & Mod Dry	10.2	7.9	12.7	2.3	1.5	3.2	0.6	0.3	1.0	99	99
	Cool & Moist	12.5	9.9	15.4	3.7	2.7	4.8	1.1	0.7	1.7	103	103
	Cool & Wet	14.7	10.4	19.6	6.1	3.8	8.8	2.2	1.2	3.3	40	40
	Mod Cool & Moist	12.2	9.8	14.8	5.7	4.4	7.2	3.0	2.3	3.7	100	100
	Mod Cool & Wet	8.2	3.3	14.1	6.0	2.5	10.4	2.7	0.7	5.3	11	11
	Mod Warm & Moist	7.2	4.3	10.5	3.8	1.8	6.1	2.0	0.8	3.5	35	35
	Mod Warm & Dry	5.1	3.0	7.5	2.8	1.5	4.3	1.2	0.7	1.9	53	53
	Mod Warm & Mod Dry	8.8	6.3	11.6	3.3	2.1	4.7	1.5	0.9	2.2	60	60
	Warm & Dry	3.0	0.0	9.0	3.0	0.0	9.0	0.0	0.0	0.0	4	4
Outside of Wilderness/Roadless	Cool & Mod Dry	18.7	11.3	27.1	2.5	0.8	4.6	0.6	0.1	1.4	29	29
	Cool & Moist	7.6	5.1	10.3	2.0	1.1	3.2	0.7	0.4	1.1	50	50
	Cool & Wet	12.2	6.0	19.9	5.2	1.5	9.2	2.1	0.2	4.7	12	12
	Mod Cool & Moist	12.7	11.0	14.6	4.9	4.0	5.8	1.9	1.5	2.4	205	205
	Mod Cool & Wet	10.9	5.6	16.9	7.2	3.8	11.0	3.9	2.1	5.9	13	13
	Mod Warm & Moist	12.0	8.4	15.9	4.4	2.9	6.2	1.7	1.2	2.3	64	64
	Mod Warm & Dry	9.1	6.0	12.4	5.4	3.4	7.6	2.1	1.2	3.1	56	56
	Mod Warm & Mod Dry	10.8	7.4	14.6	2.7	1.2	4.5	0.8	0.3	1.4	43	43
	Warm & Dry	3.0	0.0	8.0	2.0	0.0	6.8	0.7	0.0	2.0	6	6

Third, after evaluating large-snag abundance (Table 3), productivity, and species composition of the initial ten habitat type groups, the groups were collapsed into four habitat type groups. Table 4 presents large snag densities for the following preliminary collapsed habitat type groups: *Dry* is comprised of warm and dry, moderately warm dry, and moderately warm and moderately dry; *Low/Mid Elevation Moist* is comprised of cool and moderately dry moderately cool and moist, moderately cool and wet, and moderately warm and moist. *Lower Subalpine* is comprised of cool and moderately dry, cool and moist, and cool and wet. *Upper Subalpine* is comprised of cold and moderately dry, and cold. Near timberline.this group may have whitebark pine as a component whereas whitebark pine is not a component in the lower subalpine group.

Table 4: Mean snag density per acre and 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas by preliminary collapsed habitat type groups, for all northern Idaho Forests.

Wilderness / Roadless	Collapsed Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
IN	Dry	6.9	5.3	8.7	3.1	2.2	4.1	1.3	0.9	1.8	117	117
	LowMid Elev-Moist	10.7	8.8	12.7	5.3	4.2	6.5	2.7	2.1	3.4	146	146
	Lower Subalpine	12.0	10.3	13.7	3.5	2.9	4.3	1.1	0.8	1.4	242	242
	Upper Subalpine	5.5	1.0	11.2	0.8	0.0	1.8	0.8	0.0	1.8	9	9
OUT	Dry	9.4	7.2	11.8	4.1	2.8	5.5	1.4	0.9	2.1	105	105
	LowMid Elev-Moist	12.5	10.9	14.1	4.9	4.1	5.7	2.0	1.6	2.4	282	282
	Lower Subalpine	11.7	8.8	15.0	2.6	1.7	3.6	0.9	0.5	1.3	91	91
	Upper Subalpine	-	-	-	-	-	-	-	-	-	0	0

Since upper subalpine habitat type groups are uncommon in Northern Idaho, this group was combined with the Lower Subalpine into one group named *Subalpine.* This group along with Dry and Low/Mid Elevation Moist comprised the final habitat type groups used for analysis.

Table 5a: Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by final habitat type groups, for all northern Idaho Forests.

Wilderness / Roadless	Final Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
IN	Dry	6.9	5.3	8.7	3.1	2.2	4.1	1.3	0.9	1.8	117	117
	LowMid Elev-Moist	10.7	8.8	12.7	5.3	4.2	6.5	2.7	2.1	3.4	146	146
	Subalpine	11.7	10.1	13.4	3.4	2.8	4.2	1.1	0.8	1.4	251	251
OUT	Dry	9.4	7.2	11.8	4.1	2.8	5.5	1.4	0.9	2.1	105	105
	LowMid Elev-Moist	12.5	10.9	14.1	4.9	4.1	5.7	2.0	1.6	2.3	282	282
	Subalpine	11.7	8.8	15.0	2.6	1.7	3.6	0.9	0.5	1.3	91	91

Table 5b: Mean live tree density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by final habitat type groups, for all northern Idaho Forests.

Wilderness / Roadless	Final Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
IN	Dry	47.7	40.7	55.0	19.4	16.1	22.9	7.5	6.0	9.1	117	117
	LowMid Elev-Moist	64.6	58.4	70.9	28.2	25.0	31.6	11.3	9.6	13.1	146	146
	Subalpine	55.7	51.2	60.4	15.9	13.9	18.0	5.2	4.1	6.3	251	251
OUT	Dry	49.3	42.3	56.4	18.5	15.6	21.5	6.5	5.2	7.9	105	105
	LowMid Elev-Moist	62.5	57.7	67.3	26.2	23.7	28.8	10.1	8.9	11.4	282	282
	Subalpine	55.6	48.1	63.1	17.7	14.0	21.8	4.9	3.6	6.3	91	91

Table 5a and 5b show densities for snags and live-trees for the final *collapsed* habitat type groups: *Dry* is comprised of warm and dry, moderately warm dry, and moderately dry and moderately warm; *Low to Mid Elevation Moist* is comprised of moderately warm and moist, moderately cool and moist, and moderately cool and wet. *Subalpine* is comprised of cool and moist, cool and wet, and cool and moderately dry, cold and moist to moderately dry, and cold and near timberline.

There is no statistical difference in the density of snags (Table 5a) within and outside of wilderness/roadless areas. However, for some snag groups, the mean density of snags outside of roadless/wilderness, appear to higher than within which may be due to the magnitude of the 1910, 1919, 1926, and 1931 fires. Areas that burned in these fires are now in the mid-seral class of succession and may have fewer snags compared to other lands that had not been impacted by the magnitude of such fires.

Frequency and severity of fire, during various stages of succession, affect the density of snags in different ways. The Dry group has the lowest snag densities, most likely due to more frequent, low- to mid-severity fire resulting in a relatively constant level of snags at low numbers. In contrast, the Low/Mid Elevation Moist habitat type group has the highest density of snags and large-live trees, a significant difference in the 15”+ and 20”+ diameter classes as compared to the other groups. This is likely due to increased productivity and longer fire return intervals for lethal fires with mixed severity fire in between stand replacing events. Within wilderness/roadless areas, there are significantly fewer snags as diameter classes increase.

3.3 Comparison of Snag Density within and outside of Lodgepole Pine Dominance Group

Fifth, snag and live density by diameter class was explored for lodgpole pine (*Pinus contorta*, PICO) dominance groups. Examining the lodgepole pine dominance group separately is appropriate for several reasons. Lodgepole pines are uniquely characterized by their growth, form, and lack of wind firmness (Alexander 1986, Lotan 1983). Consequently, lodgepole pines fail to grow as large as other common tree species in northern Idaho Forests, and therefore do not contribute as many large diameter snags. Analyzing the lodgepole pine dominance group separately is consistent with previous Region 1 analyses of fire ecology (Fischer and Clayton 1983, Smith and Fischer 1997, Fischer and Bradley 1987) and snag density (Harris 1999).

Dominance groups of PICO and Non-PICO were classified according to the R1 Existing Vegetation Classification System. A dominance group is defined by the species with the greatest abundance of basal area or trees per acre within a setting. See Appendix D for documentation on which dominance types comprised these two groups. These dominance groups are the same classification used when updating R1-VMap for northern Idaho Forests so results can be related to VMap. For further information on dominance types see *The Region One Vegetation Classification System and its Relationship to Inventory Data and the Region1 Existing Vegetation Map Product* (Barber and others, 2009).

There is a statistically significant difference in estimates of live and dead trees per acre in the 15.0"+ DBH class and the 20.0"+ DBH class in the lodgepole pine dominance group compared to all other dominance groups, see Table 6a and 6b. Furthermore, although the density of live trees 10"DBH and larger is very similar between the PICO and non-PICO dominance groups, density of live and dead trees within the PICO dominance type group dramatically decreases in the 15"+ DBH and 20"+ DBH class as compared to the non-PICO group.

Table 6a: Mean snag density per acre with 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas by lodgepole pine dominance group (PICO) and all other dominance groups, for all northern Idaho Forests.

Wilderness /Roadless	Dominance Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
IN	All Other	11.0	9.8	12.3	4.3	3.7	4.9	1.8	1.5	2.1	434	434
	PICO	6.6	4.7	8.7	1.6	0.9	2.4	0.4	0.1	0.7	80	80
OUT	All Other	11.7	10.5	13.0	4.5	3.9	5.1	1.7	1.5	2.0	445	445
	PICO	11.2	6.0	17.4	1.0	0.2	2.1	0.4	0.1	1.0	33	33

Table 6b: Mean live tree density per acre with 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas by lodgepole pine dominance group (PICO) and all other dominance groups, for all northern Idaho Forests.

Wilderness /Roadless	Dominance Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
IN	All Other	56.8	53.2	60.6	22.3	20.5	24.1	8.6	7.7	9.6	434	434
	PICO	54.1	46.4	62.0	8.9	6.4	11.5	1.0	0.5	1.6	80	80
OUT	All Other	58.9	55.3	62.6	24.2	22.4	26.1	8.9	8.0	9.8	445	445
	PICO	49.5	37.3	62.8	5.4	3.1	8.0	0.7	0.3	1.1	33	33

3.4 Final groupings for snag density analysis on northern Idaho Forests

Finally, we calculated snag and live tree density estimates for lodgepole pine and non-lodgepole dominance groups. The non-lodgepole pine dominance group was further sub-divided by the three final habitat type groups.

Table 7a: Mean snag density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type group; for all northern Idaho Forests.

Wilderness /Roadless	Dominance Group	Final Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
IN	All Other	Dry	6.8	5.1	8.8	3.1	2.1	4.2	1.3	0.9	1.8	101	101
		LowMid Elev-Moist	10.8	8.9	12.9	5.5	4.3	6.7	2.9	2.2	3.5	139	139
		Subalpine	13.4	11.4	15.5	4.1	3.2	5.0	1.4	1.0	1.8	194	194
	PICO	All	6.6	4.7	8.7	1.6	0.9	2.4	0.4	0.1	0.7	80	80
OUT	All Other	Dry	10.1	7.7	12.7	4.5	3.1	6.1	1.6	1.0	2.3	95	95
		LowMid Elev-Moist	12.5	10.9	14.1	4.9	4.2	5.7	2.0	1.6	2.4	274	274
		Subalpine	11.0	8.2	14.1	3.0	1.9	4.2	1.0	0.5	1.6	76	76
	PICO	All	11.2	6.0	17.4	1.0	0.2	2.1	0.4	0.1	1.0	33	33

Table 7b: Mean live tree density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type group; for all northern Idaho Forests.

Wilderness /Roadless	Dominance Group	Final Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
IN	All Other	Dry	44.7	37.3	52.4	20.5	16.7	24.5	8.3	6.6	10.1	101	101
		LowMid Elev-Moist	65.1	58.7	71.6	28.9	25.6	32.4	11.8	10.0	13.6	139	139
		Subalpine	57.3	52.0	62.7	18.5	16.1	21.0	6.5	5.2	7.9	194	194
	PICO	All	54.1	46.4	62.0	8.9	6.4	11.5	1.0	0.5	1.6	80	80
OUT	All Other	Dry	48.6	41.6	55.7	19.6	16.5	22.9	7.0	5.7	8.5	95	95
		LowMid Elev-Moist	63.1	58.3	68.0	26.9	24.4	29.4	10.3	9.1	11.7	274	274
		Subalpine	56.6	48.1	65.3	20.3	16.1	25.0	5.8	4.4	7.4	76	76
	PICO	All	49.5	37.3	62.8	5.4	3.1	8.0	0.7	0.3	1.1	33	33

Table 7a and 7b show estimates of snags and large-trees for the final snag analysis groups. When looking across the entire northern Idaho portion of the Region, there are adequate plots numbers (*n*), by the final snag analysis groups, both within and outside of the wilderness/roadless areas, to make comparisons between the density of snags within and outside of wilderness/roadless areas by dominance type; PICO and all other groups, and habitat type groups: Dry, Low Mid Elevation Moist, and Subalpine.

This same information, for each Forest, is reported in Table3a and 3b in Appendix C. For the Forests, the estimates from Tables 3a, Appendix C are used as a basis for possible Forest–wide desired conditions (Table 11). However, for some snag classes, those likely most influenced by the 1910 fire, the mean number of snags within roadless/wilderness appear to be less than outside roadless/wilderness; however these estimates are not statistically significant. For Forests with snag analysis groups that do not have many plots, such as PICO dominance group on the Idaho Panhandle, the estimates for the entire northern Idaho portion of the Region within roadless/wilderness, might be more appropriate to use to define a range of desired conditions for snag densities within this group, see Table 7a.

In addition, due to the ongoing and future predicted bark beetle epidemics and fire, it is anticipated that the density of snags is increasing. See Appendix E for Regional disturbance statistics for 2000-2007.

3.5 Overview of Final Snag Analysis Groups

Snag Analysis Group 1: Warm habitat types with mixed conifer dominance groups (other than PICO)

See Appendix B for a list of habitat types included in the Dry habitat type group. These habitats are warm and dry, dominated by Douglas fir and ponderosa pine. These types generally correspond to fire groups 1, 2 and 7 (Smith and Fischer 1997), and fire groups 2-6 (Fischer and Bradley).

These habitat type groups were lumped into this snag analysis group because they generally occur in dry and warm forest conditions in northern Idaho and western Montana Forests with similar fire regimes and resulting snag densities. This group contains a highly variable group of habitat types. The group includes transition types from the dry to more moist types.

These habitat types were characterized, in naturally functioning ecosystems, by mixed species stands of Pinus ponderosa, Pseudotsuga menziesii, Larix occidentalis, and Abies grandis. Understories, in the absence of fire or other disturbance, are composed primarily of dense Pseudotsuga menziesii or Abies grandis thickets, though other tree species may be present.

The natural fire free interval for underburning was 15 to 50 years. Mixed intensity of moderate and severe fires commonly created mosaics of even-aged stands with individual and groups of trees (Smith and Fischer, 1997) surviving. Also common are open park-like stands dominated by Pinus ponderosa, Larix occidentalis and Pseudotsuga menziesii.

Snag Analysis Group 2: Low to mid elevation moist habitat types with mixed conifer dominance groups (other than PICO)

See Appendix B for a list of habitat types included in the moist group (habitat type groups 4, 5, and 6). These types generally correspond to fire groups 7, 8, and 9, (Smith and Fischer 1997).

In the moister environment of northern Idaho some of these types occur on drier aspects at mid elevations. The upland cedar and hemlock habitat types are moderately cool and moist. They can contain the greatest diversity of species; common tree species include Thuja plicata, Tsuga heterophylla, Pseudotsuga menziesii, Picea engelmannii, Abies grandis, Pinus contorta, Tsuga mertensiana, Larix occidentalis and Pinus monticola. Very high basal areas can be achieved on these types. Some areas in this group are very wet sites such as riparian areas along streams. This group is associated with wetlands or is found in upslope position where there is water near the surface and soils are saturated for at least part of the year. Many species do well on these sites and may thrive for centuries without disturbance. Thuja plicata is the most notable example.

Variable fire regimes are common, and often include both mixed severity fires on 50 to 85 year intervals as well as stand replacing fires on 150-250 year intervals. Fire free intervals can range from 50 years on the drier types to over 200 years on moister sites. All fire severities are possible within this group. Many fires are minor ground fires that create a mosaic within the stand, or mixed severity fires creating a patchy mosaic of underburn and irregular sized openings with a periodic creation of snags. In addition to mixed severity fire, root disease and periodic Douglas-fir beetle can create increasing amounts of snags during mid-seral to late-seral successional classes. Dryer sites within this group can have a stand replacing fire. Many times this is the result of a fire burning from an adjacent and drier type (Smith and Fischer, 1997). Many species grow well on these sites and may thrive for centuries without disturbance. Thuja plicata is the most notable example.

Snag Analysis Group 3: Subalpine habitat type groups with mixed conifer dominance groups (other than PICO)
This snag group is a combined class of upper and lower elevation subalpine fir habitat types. See Appendix B for a list of habitat types included in the subalpine group.

Lower subalpine habitat types with mixed conifer dominance groups (other than PICO)
See Appendix B for a list of habitat types included in the lower subalpine group. These types generally correspond to fire groups 4 and 5 (Smith and Fischer 1997), and fire groups 8 and 9 (Fischer and Bradley).

These types are characterized by cool and moist site conditions. Species diversity can be high with Larix occidentalis, Pseudotsuga menziesii, Pinus monticola, Picea Engelmannii, Pinus contorta, Abies lasiocarpa and Abies grandis. Although some of these sites (especially in some Vaccinium caespitosum and Xete types) can be quite frosty, they are usually not cold enough to give Pinus albicaulis enough of a competitive advantage to play a major successional role.

Stand replacing fires dominate this group and occurred at average intervals of 52 to 200 years or more, the long intervals occur in higher elevation areas (Smith and Fischer 1997). In areas of gentle terrain and variable topography, mixed severity burns did occur and were likely a source of snag creation during mid and late seral successional stages.

Upper subalpine fir habitat types with mixed conifer dominance groups (other than PICO)
See Appendix B for a list of habitat types included in the upper subalpine group. These types generally correspond to fire group 6 (Smith and Fischer 1997) and fire group 10 (Fischer and Bradley).

These types are upper elevation cold moist to moderately dry sites. Most of these sites are above the cold limits where conifers such as *Pseudotsuga menziesii, Larix occidentalis and Pinus monticola* are capable of being the dominant species. On most of these sites Pinus albicaulis has the potential to be a major stand component during some portion of the successional sequence. Common tree species are *Pinus albicaulis, Pinus contorta, Tsuga mertensiana, Abies lasiocarpa, Picea engelmannii*, and *Larix lyallii*. High cover of Vaccinium scoparium and/or Luzula Hitchcockii is often indicative of cold conditions where Pinus albicaulis may have some competitive advantage.

The fire free interval varies considerably from 60 to over 300 years (Smith and Fischer 1997). Mixed severity fire was typical in stands with seral whitebark pine. Low severity fires in this group removed sub-alpine fir and Englemann spruce and favored whitebark pine. Stand replacement fires occur after intervals of more than 200 years (Fischer and Bradley, 1987).

Snag Analysis Group 4: Lodgepole Pine dominance type, all habitat type groups
Lodgepole Pine is a major dominance type in Region 1 and has characteristics that have warranted special management attention in the past (Hughes 1990). This snag analysis group generally corresponds to fire group 3 (Smith and Fischer 1997) and fire group 7 (Fischer and Bradley) but also can be found on most all habitat types in northern Idaho except for the very dry and very cold conditions.

Lodgepole pine was broken out as a snag analysis group due to the tight stocking in most lodgepole pine stands. The average stand diameters are generally smaller than mixed conifer stands due to growth form and stocking levels. As a result, large snags and live trees are rare within this dominance group. The exception to this is where lodgepole pine has dominated after very large fires, many cedar and larch snags can be found 80 + years after the fire (Smith and Fischer 1997). An example of this is in the upper reaches of the St Joe River drainage (Smith and Fisher 1997). In most cases, the dominance of lodgepole pine is due to lack of seed source of other species after a fire. Due to these dominant characteristics of the silvics of lodgepole pine, this snag analysis group was not further analyzed by habitat type groups.

No fire history studies specifically address the lodgepole pine fire group 3 in northern Idaho. However, many stands are interspersed with fire group 4, which studies have shown have mean stand replacing fire intervals of 195 years, and mean nonleathal fire return intervals of 41 years (Smith and Fisher 1997). However stands reaching 80 years of age with stand size of greater than 8" in diameter, often experience severe mortality by mountain pine beetle creating snags and down fuel leading to potential severe fire effects depending on time since the infestation (Jenkins 2007). Fire intervals of severe fire reported for this type in western Montana range from 100 years to about 500 years. Some sites at high elevations, over 7,600 feet, have a longer fire return interval of 300-400 years due to a cooler moister environment (Fischer and Bradley). On lodgepole pine dominated sites, stand-replacing fire was likely most common. Severity of these fires was affected by periodic outbreaks of mountain pine beetle that led to large fuel loads and a pulse event for snag creation.

3.6 Analysis of snag density within successional stages
Snag densities and their relationship to successional stages provide context for managing forests in the short- and long-term. This information can assist with the development of site-specific stand level silvicultural prescriptions and the desired conditions over time, for the Target Stand, which is an essential part of the prescription process.

Harris (1999) found that snags were the result of several functions. There are large-live "remnant" trees surviving from the previous late-seral stage through the early and potentially mid-seral stages, which ultimately die. There are large snags, which are remnants from the previous late-seral stage trees, which were created by the disturbance that brings the stand to the early-seral stage. Finally, there is recruitment of snags during the development of late successional stage communities. We incorporated all of these aspects of snag creation into our analysis.

Wisdom and Bate (2008) found relationships of snag density to seral stage. There is not a standard definition of seral stage among the Agency. Wisdom and Bates used a definition from the Flathead National Forest, which was used in the 1990's. This definition, which looked at the trees per acre in three diameter classes and the diameter class with the most trees, determines the seral stage. For our analysis, seral stage was based on the R1 vegetation council existing vegetation classification definition of tree size, which is determined from the basal area weighted average diameter (Barber and others, 2009) of all trees found on the setting, and has been used by the Region since 2004. These setting tree size class definitions are displayed in various Region 1 reports, are consistent with attributes displayed on R1-VMap for the northern Idaho, and can be algorithmically applied to all levels of inventory data.

Trees that had ages recorded, found on FIA plots in northern Idaho, were analyzed to explore diameter/age relationships to help determine which diameter class seemed most appropriate to define the seral stages. A setting size between 0.0”-9.9” is considered early-seral and may be up to thirty years since disturbance created the class (personal communication, Bollenbacher), mid-seral is defined as all settings with an average diameter of 10.0” – 19.9”, and late-seral has a stand size of 20.0” and larger. It was found, through the analysis, that trees within this size class are at least 130 years or older. Keep in mind that these early seral forests range in age from stand initiation up to 30 years in age and may be less than the snag densities found in areas within the first 5 years since disturbance.

Table 8a: Mean snag density per acre with 90% confidence interval, inside and outside wilderness and roadless areas, by diameter class and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type groups, for all northern Idaho Forests.

Area	Dominance Group	Final Habitat Type Group	NID Seral Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other	Dry	0-9.9	2.5	0.0	6.5	1.4	0.0	3.8	0.4	0.0	1.3	23	23
			10-19.9	8.4	6.0	11.0	3.4	2.0	5.0	1.3	0.8	2.1	53	53
			20+	7.5	4.0	12.0	4.2	2.4	6.2	2.2	1.3	3.4	25	25
		LowMid Elev-Moist	0-9.9	6.6	2.7	11.2	1.4	0.0	3.8	0.6	0.0	2.0	16	16
			10-19.9	11.2	8.7	13.8	5.2	3.8	6.6	2.6	1.9	3.4	95	95
			20+	11.9	8.2	16.1	8.9	6.0	12.3	5.1	3.4	6.9	28	28
		Subalpine	0-9.9	12.4	8.2	17.1	2.9	1.4	4.9	0.6	0.2	1.0	49	49
			10-19.9	13.8	11.4	16.4	4.0	3.0	5.0	1.4	0.9	2.0	126	126
			20+	13.1	7.2	20.0	7.7	4.6	11.3	2.9	1.7	4.3	19	19
	PICO	All	0-9.9	3.7	2.0	5.6	0.9	0.2	1.9	0.2	0.0	0.7	36	36
			10-19.9	8.9	5.8	12.2	2.2	1.1	3.4	0.5	0.2	1.1	44	44
Outside Wilderness / Roadless	All Other	Dry	0-9.9	4.0	1.3	7.3	1.7	0.0	4.0	0.6	0.0	1.5	18	18
			10-19.9	12.9	9.5	16.4	5.5	3.6	7.6	1.7	0.9	2.6	60	60
			20+	6.9	2.8	12.0	4.1	1.2	8.0	2.3	0.8	4.2	17	17
		LowMid Elev-Moist	0-9.9	4.6	3.1	6.2	1.5	0.7	2.4	0.6	0.2	1.1	65	65
			10-19.9	16.2	13.8	18.6	5.8	4.7	6.9	2.0	1.5	2.6	165	165
			20+	10.2	7.6	13.3	6.8	5.0	8.8	3.9	3.0	5.0	44	44
		Subalpine	0-9.9	7.3	2.7	13.4	2.5	0.3	5.2	0.4	0.0	1.2	20	20
			10-19.9	12.4	8.8	16.5	2.8	1.6	4.1	1.0	0.5	1.6	51	51
			20+	11.2	2.0	20.8	7.6	1.5	15.0	3.8	1.0	8.5	5	5
	PICO	All	0-9.9	9.9	3.4	19.1	0.7	0.0	2.4	0.1	0.0	0.3	19	19
			10-19.9	12.9	5.5	21.2	1.3	0.2	2.8	0.9	0.1	2.1	14	14

Table 8a displays snag densities within and outside of wilderness and roadless areas by seral stage for the final snag analysis groups. The lodgepole pine group does not have any FIA plots that have a basal area weighted average diameter greater than 20.0” DBH.

The Subalpine habitat type analysis group and the Low/Mid Elevation Moist group have more snags in the early-seral stage that are 10” and larger, than the other two groups. These habitat type groups tend to have a greater proportion of stand-replacing fires (Smith and Fischer 1997), causing increased mortality of large-trees. These groups also have root disease and Douglas-fir bark beetles contributing to the creation of snags, which is reflected in the snag densities in the mid- and late-seral stages. The Dry forest habitat analysis group has a steadily increasing distribution of snags over successional stages but at lower densities than the other analysis groups. This is probably related to more frequent fire visiting these sites keeping the large snag numbers low compared to the other types.

In the other geographic areas of the Region, many of the snag analysis groups show fewer numbers of snags during the mid-seral stage, since many snags transition to down woody debris at this time (Jenkins 2007, Harris 1999, Clark 1998, Smith 1999). However, this was not the case with northern Idaho. In wilderness and roadless areas, for the largest two diameter classes, there is an increase in the number of snags as the forest matures (Table 8a; Harris 1999). This continuing influx of snags, as we see in Table 8a, could be a result of root disease and Douglas-fir beetles disturbance, creating additional snags in the mid-seral and late-seral classes. These two influences, in addition to mixed severity fire operating in these types, may play a particularly important role in maintaining snags throughout a successional pathway. For specific Forest comparisons, see Table 4a and 4b in Appendix C. Snag abundance by successional stages have less reliable estimates for each Forest, because there are less FIA plots within each seral stage by Forest.

Table 8b: Mean live tree density per acre with 90% confidence interval, within and outside of wilderness and roadless areas, by diameter class and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type groups, for all northern Idaho Forests.

Area	Dominance Group	Final Habitat Type Group	WMT Seral Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	Other	Dry	0-9.9	9.3	2.8	18.1	1.4	0.3	3.0	0.4	0.1	0.7	23	23
			10-19.9	64.1	52.9	75.6	26.4	20.7	32.5	7.8	5.7	10.0	53	53
			20+	36.1	26.7	46.2	25.4	18.8	32.5	16.7	12.5	21.0	25	25
		LowMid Elev-Moist	0-9.9	37.4	21.2	55.4	3.1	1.1	5.6	0.9	0.0	2.2	16	16
			10-19.9	70.2	62.4	78.1	30.1	26.2	34.1	10.0	8.2	11.9	95	95
			20+	63.3	51.0	76.4	39.6	32.3	47.2	24.0	19.9	28.1	28	28
		Subalpine	0-9.9	26.5	19.1	34.1	2.3	1.1	3.6	0.4	0.1	0.9	49	49
			10-19.9	70.6	64.2	77.1	22.6	19.7	25.5	6.7	5.5	8.1	126	126
			20+	48.8	34.7	64.2	33.5	23.0	45.0	20.8	13.1	29.9	19	19
	All	PICO	0-9.9	35.4	27.5	43.9	1.8	0.7	3.2	0.2	0.0	0.6	36	36
			10-19.9	69.3	58.3	81.1	14.6	10.8	18.8	1.7	0.8	2.7	44	44
Outside Wilderness / Roadless	Other	Dry	0-9.9	15.9	6.6	26.9	1.8	0.3	3.7	0.2	0.0	0.4	18	18
			10-19.9	63.3	54.3	72.6	24.4	20.4	28.6	7.4	5.8	9.1	60	60
			20+	31.5	22.3	41.2	21.6	15.7	27.8	13.0	9.5	16.7	17	17
		LowMid Elev-Moist	0-9.9	23.0	16.7	29.8	2.7	1.4	4.1	0.2	0.1	0.5	65	65
			10-19.9	78.5	72.2	84.7	31.9	29.0	35.0	9.9	8.6	11.3	165	165
			20+	64.9	55.5	74.4	43.6	37.3	50.0	26.8	23.4	30.4	44	44
		Subalpine	0-9.9	25.3	13.4	40.0	3.1	1.2	5.3	1.0	0.2	2.0	20	20
			10-19.9	71.3	61.4	81.3	26.6	21.1	32.5	7.1	5.3	9.1	51	51
			20+	32.3	15.0	54.1	25.4	12.0	42.1	12.2	6.2	18.7	5	5
	All	PICO	0-9.9	32.6	20.9	45.1	1.0	0.0	2.3	0.0	0.0	0.0	19	19
			10-19.9	72.5	52.6	94.8	11.5	7.3	16.1	1.6	0.7	2.5	14	14

To explore how large-trees transition into snags from large-live remnant trees, estimates of live trees by the 10"+ DBH, 15"+DBH, and 20"+ DBH diameter classes, by seral stage (size class) were derived (Table 8b). In the early-seral stage, the trees 15.0"+ in diameter are remnant live trees remaining after disturbance, from the previous late-seral condition. This agrees with the finding of Harris (1999) that snag creation was a function of several general categories of snags one of which was large-live "remnant" trees surviving from the previous late-seral stage. Snags are also created from large-live trees, found in the early and potentially mid-seral stages, which ultimately die. In addition, there are remnant snags, which were created by the disturbance or persist after the disturbance which created the early-seral stage condition; this can be seen in the snag estimates in Table 8a in the early-seral stage for all of the snag analysis groups. Finally, there is recruitment of snags during the development of mid and late successional stages as a part of natural succession with root disease and insects contributing in these regimes.

By displaying both estimates of within and outside of the wilderness/roadless areas, Table 8a and 8b provide context into the current condition of snag and live tree distributions, by seral stage on lands that could be treated and how they may or may not differ for wilderness/roadless areas. This may provide insight into the range of snags that may be desirable to leave within a project treatment area, and, potentially, live trees to serve as remnant trees, which will be recruited into snags.

3.7 Analysis of snag density spatially

Not only is it important to understand the distribution of snags and large-live remnant trees over time during various stages of succession, but it is important to explore how snags are distributed spatially across the landscape. Harris (1999) found a clumpy spatial distribution of snags due, in part, to the disturbances, which create snags, fire and insects.

Table 9: Percent of plots having the incidence of snags, by diameter class, for northern Idaho Forests in wilderness and roadless areas, by final dominance type and habitat type groups.

Dominance Group	Final Habitat Type Group	Percent of plots with			Percent of plots with			Percent of plots with			Total Number PSUs	Number Forested PSUs
		Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90% CI Upper Bound		
All Other	Dry	30.7%	25.0%	36.5%	22.0%	17.3%	27.1%	18.6%	14.2%	23.2%	101	101
	LowMid Elev-Moist	43.9%	38.5%	49.3%	34.5%	29.3%	39.8%	29.7%	24.7%	34.7%	139	139
	Subalpine	41.4%	37.1%	45.7%	23.5%	19.7%	27.3%	16.2%	12.9%	19.7%	194	194
PICO	All	22.5%	16.9%	28.3%	9.1%	5.5%	12.9%	5.0%	2.3%	8.1%	80	80

Table 10: Percent of plots having the incidence of snags, by diameter class, for northern Idaho Forests in wilderness and roadless areas, by final dominance type and habitat type groups, by seral stage. Seral stage (group) is based on basal area weighted average diameter: Early-seral = 0.0 – 9.9" average diameter; Mid-seral = 10.0" – 19.9" average diameter; Late-seral = 20.0" + average diameter.

Dominance Group	Final Habitat Type Group	NID Seral Group	Percent of plots with Snags 10"+			Percent of plots with Snags 15"+			Percent of plots with Snags 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90% CI Upper Bound		
Other	Dry	0-9.9	7.6%	0.0%	16.7%	5.4%	0.0%	13.1%	3.3%	0.0%	8.7%	23	23
		10-19.9	36.8%	29.2%	44.6%	22.6%	16.3%	29.4%	18.9%	13.2%	25.0%	53	53
		20+	39.0%	26.9%	51.3%	36.0%	25.0%	47.4%	32.0%	21.2%	43.4%	25	25
	LowMid Elev-Moist	0-9.9	25.0%	11.1%	40.4%	6.3%	0.0%	14.5%	4.7%	0.0%	12.5%	16	16
		10-19.9	42.1%	35.7%	48.7%	32.1%	26.1%	38.3%	26.6%	20.9%	32.6%	95	95
		20+	60.7%	49.1%	72.1%	58.9%	47.6%	70.2%	54.5%	42.9%	65.9%	28	28
	Subalpine	0-9.9	34.2%	25.5%	43.1%	14.8%	8.7%	21.4%	8.2%	3.3%	13.7%	49	49
		10-19.9	42.7%	37.4%	48.0%	23.0%	18.5%	27.7%	15.7%	11.6%	19.9%	126	126
		20+	51.3%	39.3%	63.9%	48.7%	36.1%	61.5%	40.8%	28.1%	54.2%	19	19
All	PICO	0-9.9	15.3%	8.6%	22.7%	4.9%	1.3%	9.4%	2.1%	0.0%	5.0%	36	36
		10-19.9	28.4%	20.2%	36.9%	12.5%	6.9%	18.6%	7.4%	2.8%	12.8%	44	44

We looked at how snags were distributed spatially by looking at how often FIA plots had snags occurring on them. Table 9 shows the percentage of plots that have large snags by our final snag analysis groups by diameter class. Table 10 shows the percent of plots with snags by successional stages.

As can be seen in these two tables, the distribution of snags across a landscape is not uniform. As an example, Table 10 shows in the early-seral stage class, in the Low/Mid Elevation Moist analysis group, within the 20"+ diameter class, snags occur on an average of 4.7% of the area in that class. Compare this to the late seral stage, within this analysis group, where snags occur on average over 54.5% of the plots. This, in part, is because as these types get older, insects and diseases are continually producing snags.

Since snags naturally occur in a clumpy manner, especially in the early seral stage, within a project treatment area, one should consider leaving snags in a clumpy distribution as well. The ranges of snags that remain within the entire project area, should be the average density *across* the entire project treatment area and not to every treated acre within a project area.

4.0 Discussion

Snags are naturally created over time and as various disturbance processes occur across the landscape. Appendix E shows a compilation of disturbances in Region 1 from 2000-2007. These provide context of acres of disturbance, both natural and man-made. Fire, both prescribed and natural, and insect and disease disturbances tend to create snags while harvest and firewood cutting can reduce snag density. From 2000-2007 more than 2,000,000 acres were affected by fire, more than 5 million acres were affected by insects, and less than 45,000 acres were harvested or thinned annually. Furthermore, due to the ongoing and predicted future increases in bark beetle epidemics and fire events, it is expected that there will be increasing snag densities in all diameter classes over time.

4.1 Ranges of Snags by Forest:

Table 11 displays ranges of snags per acre for each Forest, by snag analysis groups. These ranges are the 90% confidence interval lower and upper bound for the Forest specific estimates of snag density derived within roadless/wilderness lands, as displayed in Appendix C Table 3a. For all northern Idaho Forests, there were too few plots in the PICO dominance group to reliably determine ranges of snags in the 20.0"+ DBH class. Therefore, the estimates displayed in the 20.0"+ diameter class, are those confidence intervals derived for all of northern Idaho in wilderness/roadless, see table 7a. The current Forest-wide mean snag density is displayed under the ranges in parentheses, as reported in Appendix C Table 5.

This table could provide information when developing Forest wide goals for snags by these snag analysis groups. As new FIA data is acquired and available for analysis, these ranges, for a particular Forest, can be monitored over time.

Table 11: Snags per acre for northern Idaho Forests Snag Analysis Groups: lodgepole pine (PICO) dominance group and all other dominance groups by habitat type group, by diameter class. Current Forest mean is displayed in parentheses.

Forest	Dominance group	Habitat Type Group	Ranges of Snags per acre by Diameter Class		
			≥ 10.0" DBH	≥ 15.0" DBH	≥ 20.0" DBH
IPNF	All Other Groups	Dry	4.1 – 13.2 (9.4)	0.5 - 6.4 (3.9)	0.4 - 2.2 (1.1)
		Low to Mid Elevation Moist	8.6 - 15.9 (13.5)	2.9 - 6.3 (3.9)	1.3 - 3.0 (1.9)
		Subalpine	7.2 – 14.0 (11.2)	2.2 - 5.3 (3.3)	0.6 - 2.3 (1.1)
	PICO	All	1.8 – 13.7 (9.0)	0.3 - 4.4 (1.7)	0.1 - 0.7 (0.6)
Clearwater NF	All Other Groups	Dry	1.2 – 5.9 (4.0)	0.3 - 2.2 (1.7)	0.2 - 1.1 (1.0)
		Low to Mid Elevation Moist	6.8 – 12.3 (9.6)	4.3 - 8.4 (5.4)	2.4 - 4.9 (2.8)
		Subalpine	8.6 – 14.7 (11.4)	2.4 - 4.8 (3.4)	0.6 - 1.6 (1.1)
	PICO	All	3.7 – 9.1 (6.6)	0.5 - 2.7 (1.6)	0.1 – 0.7 (0.4)
Nez Perce NF	All Other Groups	Dry	5.3 - 10.5 (9.3)	2.5 - 5.3 (4.5)	1.0 - 2.4 (1.8)
		Low to Mid Elevation Moist	7.2 - 15.5 (11.3)	3.4 - 8.7 (5.7)	1.6 - 4.2 (2.6)
		Subalpine	13.6 - 21.3 (16.2)	3.3 - 6.6 (4.4)	1.0 - 2.5 (1.5)
	PICO	All	3.9 – 10.0 (7.9)	0.3 - 2.7 (0.9)	0.1 - 0.7 (0.3)

4.2 Snag Estimates by Seral Stage

Table 12 provides information on ranges of snags per acre by seral stage for northern Idaho Forests for consideration as project level design.

The information displayed in most of the table is from Tables 8a and 8b, the northern Idaho estimates of snag and live tree density, by seral stage, within wilderness and roadless areas. Since there are not many inventory plots by successional stage for each Forest (Appendix C Table 4a and 4b), these ranges are based on all of the northern Idaho wilderness/roadless inventory plots. Furthermore, snag estimates displayed in the early seral stage are from Table 7a, which are estimates for the snag analysis groups, not broken out by seral stage. These ranges were used because there were not reliable ranges in the early-seral group by the snag analysis classes presented in Tables 8a and 8b. This provides conservative ranges for these cells as t*he means for these groups in table 12 are higher than those from the more limited data from plots that did fall within the early seral stage*.

As information from the annualized FIA inventory is available, additional snag information within early seral communities may provide more reliable estimates. The ranges in Table 12 can then be updated to reflect the influence disturbance and the relationship of snags and live large "remnant" trees in early seral communities within roadless/wilderness areas. In the meantime, it may be appropriate to look at snag densities displayed in table 7a to help determine numbers of snags to mange for in early seral condition when contemplating vegetation management projects. These snag ranges can provide information on snags and live trees to retain within a project area in order to maintain ecosystem diversity for the snag resource.

The ranges presented in Table 12, should be used for the target successional stage(s) that the treatment areas are intended to result in or maintain, following treatment. Ranges displayed in the early seral stage condition might be used in areas planned for regeneration harvest where a new stand is being created. Keep in mind that early seral forests can have stand ages up to 30 years in age. The snag ranges in Table 12 may not reflect snag densities found only within the first 5 years after disturbance in areas after a stand replacing fire. In areas of intermediate harvests, such as improvement cutting and commercial thinning, the possible ranges for mid-seral or late-seral conditions can be used**, as safety guidelines allow.** If an insufficient number of snags are available for retention, consider leaving additional large-diameter live trees, which will be recruited, into snags, over time.

In Table 12, live trees, greater than 15.0" in diameter, are important contributors to snag recruitment in later seral stages. The live-large tree numbers might provide estimated trees to retain during the early seral successional stage, as trees that will be recruited as replacement snags. Additionally, live trees developing as the primary cohort, will also contribute to snag densities during the mid- and late-seral successional stages.

Table 12: Snags per acre for northern Idaho Forests Snag Analysis Groups by seral stage. Current northern Idaho mean is displayed in parentheses. Seral stage is based on basal area weighted average diameter: Early-seral = 0.0 – 9.9" average diameter, Mid-seral = 10.0" – 19.9" average diameter, Late-seral = 20.0" + average diameter.

Dominance Group	Habitat Type Group	Ranges per acre in *Early-seral* Conditions		
		Snags ≥ 15"+ DBH	Snags ≥ 20.0" DBH	Live trees ≥ 15.0" DBH
All Other Groups	Dry	2.1-4.2 (3.1)	0.9-1.8 (1.3)	0.3 - 3.0 (1.4)
	Low and Mid Elevation Moist	4.3-6.7 (5.5)	2.2-3.5 (2.9)	1.1 - 5.6 (3.1)
	Subalpine	3.2-5.0 (4.1)	1.0-1.8 (1.4)	1.1 - 3.6 (2.6)
PICO	All	0.9-2.4 (1.6)	0.1 - 0.7 (.4)	0.7 – 3.2 (1.8)
		Ranges per acre in *Mid-seral* Conditions		
		Snags ≥ 15"+ DBH	Snags ≥ 20.0" DBH	Live trees ≥ 15.0" DBH
All Other Groups	Dry	2.0 - 5.0 (3.4)	0.8 - 2.1 (1.3)	20.7 – 32.5 (26.4)
	Low and Mid Elevation Moist	3.8 - 6.6 (5.2)	1.9 - 3.4 (2.6)	26.2 – 34.1 (30.1)
	Subalpine	3.0– 5.0 (4.0)	0.9 – 2.0 (1.4)	19.7 – 25.5 (22.6)
PICO	All	1.1 - 3.4 (2.2)	0.2 - 1.1 (0.5)	10.8 – 18.8 (14.6)
		Ranges per acre in *Late-seral* Conditions		
		Snags ≥ 15"+ DBH	Snags ≥ 20.0" DBH	Live trees ≥ 15.0" DBH
All Other Groups	Dry	2.4 - 6.2 (4.2)	1.3 - 3.4 (2.2)	18.8 - 32.5 (25.4)
	Low and Mid Elevation Moist	6.0 - 12.3 (8.9)	3.4 - 6.9 (5.1)	32.3 - 47.2 (39.6)
	Subalpine	4.6 -11.3 (7.7)	1.7 - 4.3 (2.9)	23.0- 45.0 (33.5)
PICO	All	-	-	-

Snags are characteristically clumpy (Harris 1999 Table 10) in their distribution, thus the ranges in Table 12 do not need to be applied to every acre within a treatment area, but should be the average density of snags within the total treatment unit acreage or even the entire project area. Monitoring should be done at the project level during project design and implementation. Using cruise data from the treatment units can assist with information on snag density.

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Appendix A. Overview of Forest Inventory and Analysis (FIA) data and analysis techniques used to produce snag estimates

The national Forest Inventory and Analysis (FIA) program provides a congressionally mandated, statistically-based, continuous inventory of the forest resources of the United States. Since 1930, the FIA program has been administered through the Research and Development branch of the Forest Service, which makes it administratively independent from the National Forest System. The Interior West Forest Inventory and Analysis work unit (IW-FIA), headquartered at the USFS Rocky Mountain Research Station in Ogden, Utah oversees the FIA inventory in Region 1. More information on IW-FIA is available on the internet at: http://www.fs.fed.us/rm/ogden/sitemap/index.shtml.

FIA inventory design is based on a national hexagon of inventory plots. Data is collected on all forested portions of the plots, throughout the United States, regardless of ownership. FIA protocols specify sample plot location within this hexagonal grid. Data collection standards are strictly controlled by FIA protocols. The sample design and data collection methods are scientifically designed, publicly disclosed, and repeatable. Data collection protocols are publicly available on the internet (http://www.fia.fs.fed.us/). There are also stringent quality control standards and procedures, carried out by FIA personnel of the Rocky Mountain Research Station. All of this is designed to assure that data is collected consistently throughout the United States, and that stated accuracy standards are met by the field crews.

To estimate snag density for large areas, such as the Northern Region, individual National Forests, or even large landscape areas, it is infeasible to maintain an inventory for every acre of the millions of acres of forestland. FIA provides a statistically-sound representative sample designed to provide unbiased estimates of forest conditions at broad- and mid-levels. The FIA sampling frame uniformly covers all forested lands, regardless of management emphasis. Therefore, wilderness areas, roadless areas, and actively managed lands all have the same probability of being sampled.

Table 1: Date of Inventory for northern Idaho National Forests

Northern Idaho Forests	Date of FIA Periodic Inventory
Clearwater	1998-2002
Idaho Panhandle	2000-2002
Nez Perce	2000-2002

Using FIA data to assess the density of snags allows the Region to base its monitoring on an unbiased, statistically sound, independently designed and implemented representative sample of forest lands that is remeasured over time. This inventory is current because FIA plots in Region 1 on the northern Idaho Forests were inventoried during 1998 to 2003 (see Table 1 for specific inventory year for northern Idaho). To remain current, FIA is re-measuring 10% of its plots every year. As these re-measured plots accumulate and become available to the Region, snag density estimates will be updated. The snag estimates from FIA contained in this report are conservative based on the fact that both wildfire and bark beetle infestation has occurred since the date of inventory creating substantially more snags. See Appendix E.

All northern Idaho plots utilized a primary sample unit (PSU) composed of four fixed radius plots with trees 5 – 20.9 inches tallied on a 1/24th acre plot and trees 21.0 inches DBH and larger tallied on a ¼ acre plot.

Analysis Techniques
The R1-FIA Summary Database was used to conduct this analysis. As its name suggests, this database is comprised of several tables of summarized attributes derived from FIA field-collected data. This database has the functionality to compute the mean and confidence intervals for snag density.

Because FIA data comes from a statistical sample rather than a 100% census, attributes calculated from this data are estimates and the accuracy of these estimates can be computed and reported as confidence intervals. To calculate the confidence intervals a technique called "bootstrapping" is used. Bootstrapping is a statistical method that is independent of the distribution of the underlying data. For more information on bootstrapping, see Leach (2002) *A Case Study in the Evaluation of Confidence Interval Algorithms* and Leach (2005) *Bootstrap Calculation of Confidence Intervals for the Estimates of Means by Stratum.*

The Northern Region uses a 90%-confidence interval for describing the reliability of these estimates. The 90% level was chosen to provide a fairly precise level for a biological attribute that can be very variable. It can be thought that if a different set of randomized sample points were collected 100 different times, the estimates of snags would be within the 90%-confidence interval 90% of the time. This also indicates that if every snag on every acre were measured, there is a 90% probability that the true number of snags for the population would be within this confidence interval. Or that 9 out of 10 times, the true population mean is within the confidence interval derived from the sample.

For further information on the R1 FIA Summary Database, see *Overview of R1 FIA Summary Database*, Bush and others (2006).

Appendix B: Initial and Final Habitat Type Groups used in the western Montana Snag Density Analysis.

Habitat type alpha and numeric ADP code are as defined in *Forest Habitat Types of Montana* (Pfister and others, 1977) and *Forest Habitat Types of North Idaho: a Second Approximation* (Cooper and others, 1991).

Final Habitat Type Group	Initial Habitat Type Group	Lower Clark Fork Forest Plan Group (2005)	Alpha Code	Numeric ADP Code
Dry	Warm & Dry	1	pifl	090
			pifl/agsp	091
			pifl/feid	092
			pifl/feid-feid	093
			pifl/feid-fesc	094
			pifl/juco	095
			pipo	100
			pipo/and	110
			pipo/agsp	130
			pipo/feid	140
			pipo/feid-feid	141
			pipo/feid-fesc	142
			pipo/putr	160
			pipo/putr-agsp	161
			pipo/putr-feid	162
			psme/agsp	210
			psme/feid	220
			psme/fesc	230
			psme/syal-agsp	311
			psme/caru-agsp	321
			psme/syor	380
Dry	Moderately Warm & Dry	2	pipo/syal	170
			pipo/syal-syal	171
			pipo/syal-bere	172
			pipo/prvi	180
			pipo/prvi-prvi	181
			pipo/prvi-shca	182
			pipo/phma	190
			psme/vaca	250
			psme/phma	260
			psme/phma-phma	261
			psme/phma-caru	262
			psme/phma-smst	263
			psme/vagl	280
			psme/vagl-vagl	281
			psme/vagl-aruv	282
			psme/vagl-xete	283
			psme/libo-caru	292

Final Habitat Type Group	Initial Habitat Type Group	Lower Clark Fork Forest Plan Group (2005)	Alpha Code	Numeric ADP Code
			psme/syal	310
			psme/syal-caru	312
			psme/syal-syal	313
			psme/caru	320
			psme/caru-aruv	322
			psme/caru-caru	323
			psme/caru-pipo	324
			psme/cage	330
			psme/spbe	340
			psme/aruv	350
			psme/juco	360
			psme/arco	370
			abgr/spbe	505
			abgr/phma	506
			abgr/phma-cooc	507
			abgr/phma-phma	508
Dry	Moderately Warm & Moderately Dry	3	psme/libo	290
			psme/libo-syal	291
			psme/libo-vagl	293
			abgr/xete	510
			abgr/xete-cooc	511
			abgr/xete-vagl	512
			abgr/vagl	515
			abgr/clun-xete	523
			abgr/libo	590
			abgr/libo-libo	591
			abgr/libo-xete	592
LowMidElev-Moist	Moderately Warm & Moist	4	abgr/asca	516
			abgr/asca-asca	517
			abgr/asca-mefe	518
			abgr/asca-tabr	519
			abgr/clun	520
			abgr/clun-clun	521
			abgr/clun-arnu	522
			abgr/clun-phma	524
			abgr/clun-mefe	525
			abgr/clun-tabr	526
			abgr/setr	529
LowMidElev-Moist	Moderately Cool & Moist	5	thpl/clun	530
			thpl/clun-clun	531
			thpl/clun-arnu	532
			thpl/clun-mefe	533
			thpl/clun-xete	534
			thpl/clun-tabr	535

Final Habitat Type Group	Initial Habitat Type Group	Lower Clark Fork Forest Plan Group (2005)	Alpha Code	Numeric ADP Code
			thpl/asca	545
			thpl/asca-asca	546
			thpl/asca-mefe	547
			thpl/asca-tabr	548
			thpl/gydr	555
			tshe/gydr	565
			tshe/clun	570
			tshe/clun-clun	571
			tshe/clun-arnu	572
			tshe/clun-mefe	573
			tshe/clun-xete	574
			tshe/asca	575
			tshe/asca-arnu	576
			tshe/asca-mefe	577
			tshe/asca-asca	578
LowMidElev-Moist	Moderately Cool & Wet	6	thpl/atfi	540
			thpl/atfi-adpe	541
			thpl/atfi-atfi	542
			thpl/opho	550
			thpl/adpe	560
Subalpine	Cool & Moist	7	picea/clun	420
			picea/clun-vaca	421
			picea/clun-clun	422
			picea/sest	460
			picea/sest-psme	461
			picea/sest-picea	462
			picea/libo	470
			tshe/mefe	579
			abla/clun	620
			abla/clun-clun	621
			abla/clun-arnu	622
			abla/clun-vaca	623
			abla/clun-xete	624
			abla/clun-mefe	625
			abla/libo	660
			abla/libo-libo	661
			abla/libo-xete	662
			abla/mefe	670
			abla/mefe-cooc	671
			abla/mefe-xete	673
			tsme/mefe	680
			tsme/mefe-xete	682
			tsme/clun	685
			tsme/clun-mefe	686
			tsme/clun-xete	687

Final Habitat Type Group	Initial Habitat Type Group	Lower Clark Fork Forest Plan Group (2005)	Alpha Code	Numeric ADP Code
			abla/alsi	740
Subalpine	Cool & Wet	8	picea/eqar	410
			picea/gatr	440
			picea/smst	480
			abla/opho	610
			abla/gatr	630
			abla/stam	635
			abla/stam-mefe	636
			abla/stam-lica	637
			abla/caca	650
			abla/caca-caca	651
			abla/caca-lica	652
			abla/caca-gatr	653
			abla/caca-vaca	654
			abla/caca-legl	655
			tsme/stam	675
			tsme/stam-mefe	677
Subalpine	Cool & Moderately Dry	9	picea/phma	430
			picea/vaca	450
			abla/vaca	640
			abla/libo-vasc	663
			abla/xete	690
			abla/xete-vagl	691
			abla/xete-cooc	693
			tsme/xete	710
			tsme/xete-vagl	712
			abla/vagl	720
			abla/caru	750
			abla/arco	780
			abla/cage	790
			abla/cage-cage	791
			abla/cage-psme	792
			pico/putr	910
			pico/vaca	920
			pico/libo	930
			pico/caru	950
Subalpine	Cool & Moist	10	abla/mefe-luhi	672
			abla/mefe-vasc	674
			tsme/mefe-luhi	681
Subalpine	Cool & Wet	10	tsme/stam-luhi	676
Subalpine	Cool & Moderately Dry	10	abla/xete-vasc	692
			abla/xete-luhi	694
			tsme/xete-luhi	711
			tsme/xete-vasc	713
			abla/vasc	730

Final Habitat Type Group	Initial Habitat Type Group	Lower Clark Fork Forest Plan Group (2005)	Alpha Code	Numeric ADP Code
			abla/vasc-caru	731
			abla/vasc-vasc	732
Subalpine	Cool & Moist	10	abla/vasc-thoc	733
Subalpine	Cool & Moist	10	abla/luhi-mefe	832
Subalpine	Cold & Moderately Dry	10	abla/clps	770
Subalpine	Cold & Moderately Dry	10	abla/rimo	810
Subalpine	Cold & Moderately Dry	10	abla-pial/vasc	820
Subalpine	Cold & Moderately Dry	10	abla/luhi	830
Subalpine	Cold & Moderately Dry	10	abla/luhi-vasc	831
Subalpine	Cold & Moderately Dry	10	tsme/luhi	840
Subalpine	Cold & Moderately Dry	10	tsme/luhi-vasc	841
Subalpine	Cold & Moderately Dry	10	tsme/luhi-mefe	842
Subalpine	Cold & Moderately Dry	10	pico/xete	925
Subalpine	Cold & Moderately Dry	10	pico/vasc	940
Subalpine	Cold	11	pial-abla	850
Subalpine	Cold	11	laly-abla	860
Subalpine	Cold	11	pial	870
Subalpine	Cold	11	timberline	890
Subalpine	Rock/scree	Rock/scree	rock, scree	010

Appendix C: Snag and live tree estimates for northern Idaho Forests

Table 1: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for each northern Idaho Forest.

Area	Wilderness / Roadless	Habitat Type Group	Snags per Acre 10"+ Mean	Snags per Acre 10"+ 90% CI - Lower Bound	Snags per Acre 10"+ 90% CI - Upper Bound	Snags per Acre 15"+ Mean	Snags per Acre 15"+ 90% CI - Lower Bound	Snags per Acre 15"+ 90% CI - Upper Bound	Snags per Acre 20"+ Mean	Snags per Acre 20"+ 90% CI - Lower Bound	Snags per Acre 20"+ 90% CI - Upper Bound	Total Number PSUs	Number Forested PSUs
Idaho Panhandle NF	IN	Cold	2.0	0.0	4.0	2.0	0.0	4.0	2.0	0.0	4.0	1	1
		Cold & Moderately Dry	4.8	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	5	5
		Cool & Moderately Dry	6.7	2.3	12.2	1.5	0.1	3.2	0.3	0.0	0.7	15	15
		Cool & Moist	10.9	6.4	16.1	4.9	2.5	7.7	1.7	0.5	3.2	26	26
		Cool & Wet	14.4	7.0	22.9	4.3	1.5	7.5	2.3	0.7	4.2	12	12
		Moderately Cool & Moist	12.3	8.5	16.4	4.0	2.4	5.8	2.1	1.3	3.0	48	48
		Moderately Cool & Wet	12.5	1.5	26.7	9.5	1.5	20.0	3.5	0.0	9.0	4	4
		Moderately Warm & Dry	8.6	3.3	14.6	4.3	0.0	9.2	1.3	0.0	2.9	10	10
		Moderately Warm & Moderately Dry	6.0	1.0	12.2	1.5	0.1	4.0	0.8	0.1	1.5	8	8
		Moderately Warm & Moist	7.5	0.0	18.1	1.5	0.0	6.0	0.0	0.0	0.0	4	4
	OUT	Cool & Moderately Dry	27.6	14.1	42.5	5.2	1.1	10.2	0.3	0.0	0.6	11	11
		Cool & Moist	6.8	4.1	9.8	1.7	0.8	2.8	0.6	0.2	1.1	37	37
		Cool & Wet	12.0	6.0	18.1	6.0	0.0	14.6	3.0	0.0	9.0	4	4
		Moderately Cool & Moist	13.8	11.6	16.2	4.7	3.7	5.7	1.8	1.3	2.3	142	142
		Moderately Cool & Wet	9.0	3.0	16.4	5.3	1.9	9.1	3.0	1.0	5.4	8	8
		Moderately Warm & Dry	8.8	5.1	13.1	4.8	2.6	7.3	1.4	0.6	2.3	30	30
		Moderately Warm & Moderately Dry	11.9	6.9	17.3	2.2	0.2	4.5	0.3	0.0	0.8	13	13
		Moderately Warm & Moist	18.2	9.6	28.7	4.8	1.6	8.9	0.9	0.3	1.7	14	14
		Warm & Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1

Table 1 continued: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for each northern Idaho Forest.

Area	Wilderness / Roadless	Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Clearwater NF	IN	Cool & Moderately Dry	6.5	3.7	9.5	1.9	0.8	3.4	0.6	0.2	1.2	36	36
		Cool & Moist	11.9	8.3	16.0	2.7	1.6	4.1	0.5	0.2	0.7	50	50
		Cool & Wet	10.5	4.6	18.3	5.4	2.1	9.5	2.4	0.5	4.6	14	14
		Moderately Cool & Moist	11.3	7.6	15.4	7.4	4.6	10.5	4.1	2.6	5.8	32	32
		Moderately Cool & Wet	5.6	0.0	12.0	4.4	0.0	9.5	2.0	0.0	6.3	5	5
		Moderately Warm & Dry	2.8	0.2	6.8	0.5	0.1	0.9	0.5	0.1	0.9	13	13
		Moderately Warm & Moderately Dry	7.1	3.1	12.1	2.9	0.9	5.4	1.1	0.3	2.4	17	17
		Moderately Warm & Moist	7.0	3.6	10.8	4.3	1.7	7.3	2.6	0.8	4.9	22	22
	OUT	Cool & Moderately Dry	12.0	0.0	24.1	0.0	0.0	0.0	0.0	0.0	0.0	2	2
		Cool & Moist	10.3	3.4	19.2	3.7	0.8	7.9	1.2	0.5	1.9	10	10
		Cool & Wet	13.0	1.3	30.4	4.6	0.0	11.0	2.2	0.0	6.6	5	5
		Moderately Cool & Moist	9.9	7.2	12.8	4.9	3.3	6.7	2.2	1.2	3.4	55	55
		Moderately Cool & Wet	9.8	2.0	19.5	9.8	1.9	19.3	5.3	1.3	9.0	4	4
		Moderately Warm & Dry	5.0	1.0	9.7	3.3	0.7	6.7	2.4	0.3	5.6	7	7
		Moderately Warm & Moderately Dry	5.8	0.0	14.5	2.2	0.0	6.0	1.0	0.0	2.8	5	5
		Moderately Warm & Moist	10.0	3.5	18.0	3.7	1.2	7.3	1.6	0.7	2.7	18	18

Table 1 continued: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for each northern Idaho Forest.

Area	Wilderness / Roadless	Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Nez Perce	IN	Cold	2.5	0.0	5.0	2.5	0.0	5.0	2.5	0.0	5.0	2	2
		Cold & Moderately Dry	18.1	6.0	33.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
		Cool & Moderately Dry	14.2	10.2	18.5	2.9	1.6	4.3	0.8	0.3	1.4	48	48
		Cool & Moist	15.3	9.5	21.8	4.3	2.3	6.9	1.9	0.7	3.6	27	27
		Cool & Wet	19.2	11.0	29.3	8.4	3.4	14.7	2.0	0.6	3.8	14	14
		Moderately Cool & Moist	13.3	8.3	18.9	7.3	4.0	11.1	3.4	1.8	5.3	20	20
		Moderately Cool & Wet	6.0	0.0	18.0	3.0	0.0	6.0	3.0	0.0	6.0	2	2
		Moderately Warm & Dry	4.9	2.3	8.2	3.3	1.5	5.4	1.5	0.7	2.5	30	30
		Moderately Warm & Moderately Dry	10.3	6.7	14.3	3.9	2.1	6.1	1.9	1.0	3.0	35	35
		Moderately Warm & Moist	7.5	1.0	15.8	3.5	0.0	8.9	1.4	0.0	3.5	9	9
		Warm & Dry	3.0	0.0	9.0	3.0	0.0	9.0	0.0	0.0	0.0	4	4
	OUT	Cool & Moderately Dry	13.4	5.3	24.2	0.9	0.0	2.4	0.9	0.0	2.4	16	16
		Cool & Moist	8.4	0.0	15.0	0.3	0.0	1.0	0.3	0.0	1.0	3	3
		Cool & Wet	11.0	0.0	27.1	5.0	0.0	15.0	0.7	0.0	2.0	3	3
		Moderately Cool & Moist	13.7	3.8	28.8	8.4	2.3	18.5	3.1	1.2	5.4	8	8
		Moderately Cool & Wet	30.1	12.0	48.1	12.0	6.0	18.1	6.0	0.0	12.0	1	1
		Moderately Warm & Dry	10.9	4.3	18.7	7.1	2.5	12.5	3.0	1.0	5.4	19	19
		Moderately Warm & Moderately Dry	11.3	6.3	16.8	3.1	0.8	6.0	1.0	0.2	2.0	25	25
		Moderately Warm & Moist	10.4	6.3	15.1	4.7	2.6	7.3	2.1	1.2	3.1	32	32
		Warm & Dry	3.6	0.0	10.0	2.4	0.0	8.0	0.8	0.0	2.5	5	5

Table 2a: (document section 3.2, table 5a) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas, by final habitat type groups, for each northern Idaho Forest.

Area	Wilderness / Roadless	Final Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
Idaho Panhandle NF	IN	Dry	7.5	3.7	11.6	3.1	0.7	5.9	1.1	0.4	2.0	18	18
		LowMid Elev-Moist	11.9	8.6	15.7	4.2	2.7	5.9	2.0	1.3	2.9	56	56
		Subalpine	9.9	7.0	13.1	3.4	2.2	4.9	1.3	0.6	2.1	59	59
	OUT	Dry	9.5	6.6	12.8	3.9	2.3	5.7	1.0	0.5	1.7	44	44
		LowMid Elev-Moist	14.0	11.8	16.2	4.7	3.8	5.7	1.7	1.3	2.2	164	164
		Subalpine	11.6	7.8	15.9	2.8	1.5	4.2	0.7	0.3	1.3	52	52
Clearwater NF	IN	Dry	5.2	2.5	8.5	1.8	0.7	3.3	0.8	0.3	1.6	30	30
		LowMid Elev-Moist	9.2	6.8	11.9	6.0	4.1	8.0	3.4	2.3	4.6	59	59
		Subalpine	9.8	7.5	12.2	2.8	1.9	3.8	0.8	0.4	1.2	100	100
	OUT	Dry	5.3	1.7	9.6	2.8	0.9	5.2	1.8	0.4	3.8	12	12
		LowMid Elev-Moist	9.9	7.4	12.6	4.9	3.5	6.4	2.2	1.5	3.1	77	77
		Subalpine	11.3	5.6	18.0	3.5	1.2	6.5	1.4	0.5	2.7	17	17
Nez Perce NF	IN	Dry	7.5	5.3	10.0	3.6	2.3	5.0	1.6	1.0	2.3	69	69
		LowMid Elev-Moist	11.2	7.3	15.5	5.9	3.4	8.7	2.8	1.6	4.2	31	31
		Subalpine	15.0	12.0	18.3	4.1	2.9	5.5	1.3	0.8	1.9	92	92
	OUT	Dry	10.4	6.7	14.5	4.6	2.4	7.2	1.7	0.8	2.8	49	49
		LowMid Elev-Moist	11.5	7.4	16.1	5.6	3.4	8.4	2.4	1.6	3.3	41	41
		Subalpine	12.4	6.2	20.5	1.4	0.1	3.1	0.8	0.1	1.9	22	22

Table 2b: (document section 3.2, table 5b) Mean live tree density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by final habitat type groups, for each northern Idaho Forest.

Area	Wilderness / Roadless	Final Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
Idaho Panhandle NF	IN	Dry	50.5	32.8	69.5	17.7	9.4	27.4	4.3	1.8	7.3	18	18
		LowMid Elev-Moist	58.4	50.3	66.7	23.4	18.5	28.5	9.0	6.2	12.0	56	56
		Subalpine	55.5	46.2	65.4	19.2	14.7	24.0	5.9	3.5	8.7	59	59
	OUT	Dry	48.0	37.2	59.6	19.3	14.4	24.8	5.9	4.3	7.6	44	44
		LowMid Elev-Moist	63.2	57.2	69.3	24.7	21.7	27.8	7.9	6.6	9.4	164	164
		Subalpine	60.8	50.1	71.7	20.4	14.9	26.3	5.0	3.3	6.9	52	52
Clearwater NF	IN	Dry	52.7	35.5	71.1	17.7	11.2	25.1	5.1	2.5	8.2	30	30
		LowMid Elev-Moist	67.4	56.6	78.5	28.4	23.3	33.9	11.5	8.9	14.3	59	59
		Subalpine	59.6	51.7	67.5	17.0	13.7	20.6	5.7	4.0	7.8	100	100
	OUT	Dry	41.9	24.8	61.3	18.0	10.4	26.4	4.9	2.1	8.3	12	12
		LowMid Elev-Moist	57.6	48.9	66.4	24.2	19.9	28.6	10.3	8.0	12.7	77	77
		Subalpine	46.5	30.9	63.3	17.0	10.1	24.7	4.9	2.4	7.6	17	17
Nez Perce NF	IN	Dry	44.9	37.1	53.1	20.6	16.3	25.3	9.4	7.2	11.7	69	69
		LowMid Elev-Moist	70.6	56.7	85.2	36.7	29.8	44.1	15.0	11.5	18.7	31	31
		Subalpine	51.6	44.8	58.6	12.6	9.8	15.6	4.1	2.9	5.3	92	92
	OUT	Dry	52.2	41.7	63.2	17.8	13.9	21.9	7.5	5.3	9.7	49	49
		LowMid Elev-Moist	69.0	55.0	83.5	36.3	28.1	44.6	18.3	14.1	22.8	41	41
		Subalpine	50.3	37.1	64.6	12.1	6.1	19.0	4.6	2.2	7.5	22	22

Table 3a: (document section 3.4, Table 7a) Mean snag density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type group; for each northern Idaho Forest.

Area	Wilderness /Roadless	Dominance Group	Final Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Idaho Panhandle NF	IN	All Other	Dry	8.4	4.1	13.2	3.1	0.5	6.4	1.1	0.3	2.2	15	15
			LowMid Elev-Moist	12.0	8.6	15.9	4.4	2.9	6.3	2.1	1.3	3.0	53	53
			Subalpine	10.4	7.2	14.0	3.6	2.2	5.3	1.4	0.6	2.3	49	49
		PICO	All	7.0	1.8	13.7	2.1	0.3	4.4	0.6	0.0	1.7	16	16
	OUT	All Other	Dry	9.8	6.8	13.2	4.1	2.4	6.0	1.1	0.5	1.8	42	42
			LowMid Elev-Moist	14.0	11.9	16.3	4.8	3.9	5.8	1.8	1.4	2.3	157	157
			Subalpine	11.1	7.2	15.6	3.0	1.6	4.6	0.8	0.3	1.4	46	46
		PICO	All	12.4	5.3	20.4	1.5	0.1	3.8	0.3	0.0	0.8	15	15
Clearwater NF	IN	All Other	Dry	3.2	1.2	5.9	1.1	0.3	2.2	0.6	0.2	1.1	23	23
			LowMid Elev-Moist	9.4	6.8	12.3	6.3	4.3	8.4	3.6	2.4	4.9	55	55
			Subalpine	11.5	8.6	14.7	3.6	2.4	4.8	1.0	0.6	1.6	74	74
		PICO	All	6.2	3.7	9.1	1.5	0.5	2.7	0.4	0.0	0.9	37	37
	OUT	All Other	Dry	5.3	1.7	9.6	2.8	0.9	5.3	1.8	0.4	3.8	12	12
			LowMid Elev-Moist	9.8	7.2	12.6	4.9	3.4	6.4	2.2	1.4	3.1	76	76
			Subalpine	12.0	5.6	19.6	3.9	1.3	7.2	1.5	0.5	3.0	15	15
		PICO	All	10.7	2.5	19.1	2.7	0.0	8.0	2.7	0.0	8.0	3	3
Nez Perce NF	IN	All Other	Dry	7.8	5.3	10.5	3.9	2.5	5.4	1.7	1.0	2.4	63	63
			LowMid Elev-Moist	11.2	7.2	15.5	5.9	3.4	8.7	2.8	1.6	4.2	31	31
			Subalpine	17.3	13.6	21.3	4.9	3.3	6.6	1.7	1.0	2.5	71	71
		PICO	All	6.7	3.9	10.0	1.4	0.3	2.7	0.3	0.0	0.7	27	27
	OUT	All Other	Dry	11.8	7.5	16.5	5.5	2.8	8.5	2.1	1.0	3.3	41	41
			LowMid Elev-Moist	11.5	7.5	16.1	5.6	3.4	8.3	2.4	1.6	3.3	41	41
			Subalpine	9.7	5.1	14.9	2.1	0.2	4.5	1.2	0.1	2.8	15	15
		PICO	All	10.1	2.2	21.6	0.1	0.0	0.3	0.1	0.0	0.3	15	15

Table 3b: (document section 3.4, table 7b) Mean live tree density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type group; for all each northern Idaho Forest.

Area	Wilderness /Roadless	Dominance Group	Final Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Idaho Panhandle NF	IN	All Other	Dry	45.8	26.3	67.6	18.8	9.0	30.2	4.0	1.5	7.3	15	15
			LowMid Elev-Moist	59.3	51.0	68.0	24.1	19.2	29.4	9.5	6.6	12.6	53	53
			Subalpine	60.6	49.9	71.8	21.6	16.4	27.1	7.1	4.2	10.4	49	49
		PICO	All	40.9	28.1	54.5	8.6	4.3	13.6	1.1	0.0	3.1	16	16
	OUT	All Other	Dry	49.1	38.0	61.0	19.8	14.6	25.4	6.1	4.5	7.9	42	42
			LowMid Elev-Moist	64.2	58.1	70.6	25.6	22.6	28.8	8.3	6.9	9.7	157	157
			Subalpine	60.4	49.0	72.1	22.0	16.0	28.5	5.6	3.7	7.7	46	46
		PICO	All	46.9	32.0	62.6	6.4	2.9	10.3	0.3	0.0	0.8	15	15
Clearwater NF	IN	All Other	Dry	47.5	28.0	69.0	17.9	10.0	27.1	6.4	3.0	10.3	23	23
			LowMid Elev-Moist	67.5	56.3	79.4	29.2	23.7	35.0	12.2	9.5	15.1	55	55
			Subalpine	62.3	53.2	71.7	20.1	16.1	24.4	7.5	5.3	10.2	74	74
		PICO	All	56.7	44.4	69.7	11.0	7.1	15.3	0.9	0.3	1.6	37	37
	OUT	All Other	Dry	41.9	24.7	61.3	18.0	10.4	26.5	4.9	2.1	8.3	12	12
			LowMid Elev-Moist	57.7	48.8	66.7	24.4	20.0	28.9	10.4	8.0	12.8	76	76
			Subalpine	47.9	31.1	66.1	18.4	10.7	26.9	5.5	2.7	8.5	15	15
		PICO	All	41.5	7.0	74.9	7.4	1.7	13.3	1.3	0.0	3.0	3	3
Nez Perce NF	IN	All Other	Dry	43.4	35.2	52.1	21.8	17.2	26.7	10.1	7.7	12.5	63	63
			LowMid Elev-Moist	70.6	56.7	85.1	36.7	29.7	43.9	15.0	11.5	18.7	31	31
			Subalpine	49.8	42.2	57.6	14.7	11.4	18.2	5.1	3.7	6.6	71	71
		PICO	All	58.3	44.9	72.2	6.1	2.4	10.8	1.1	0.2	2.2	27	27
	OUT	All Other	Dry	50.1	39.8	60.9	19.9	15.6	24.4	8.6	6.1	11.2	41	41
			LowMid Elev-Moist	69.0	55.0	83.4	36.3	28.1	44.6	18.3	14.1	22.7	41	41
			Subalpine	53.7	35.7	72.8	17.3	9.2	26.5	6.8	3.4	10.6	15	15
		PICO	All	53.8	32.6	77.4	4.1	0.7	8.3	0.9	0.1	1.8	15	15

Table 4a: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for each northern Idaho Forest.

Area	Wilderness /Roadless	Dominance Group	Final Habitat Type Group	NID Seral Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
					Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Idaho Panhandle NF	IN	Other	Dry	0-9.9	1.5	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
				10-19.9	10.2	4.7	16.3	2.9	0.3	6.6	1.1	0.3	2.1	10	10
				20+	18.0	7.0	32.1	18.0	7.0	32.1	6.0	1.0	12.0	1	1
			LowMid Elev-Moist	0-9.9	9.1	3.8	15.1	2.0	0.0	5.7	0.9	0.0	3.0	11	11
				10-19.9	13.0	8.3	18.4	4.5	2.6	6.8	1.8	1.0	2.8	34	34
				20+	11.9	4.7	20.5	7.4	2.9	13.0	5.1	2.3	8.2	8	8
			Subalpine	0-9.9	5.5	0.0	13.5	0.1	0.0	0.4	0.1	0.0	0.4	10	10
				10-19.9	10.1	6.8	13.7	3.5	2.0	5.2	1.4	0.5	2.6	34	34
				20+	22.1	5.7	41.9	11.2	3.0	21.7	3.8	1.0	7.0	5	5
		All	PICO	0-9.9	2.3	0.0	7.4	1.5	0.0	4.8	0.8	0.0	3.0	8	8
				10-19.9	11.8	2.0	24.0	2.8	0.0	6.3	0.5	0.0	1.3	8	8
	OUT	Other	Dry	0-9.9	4.7	0.0	10.7	2.0	0.0	6.0	0.7	0.0	2.4	9	9
				10-19.9	12.7	8.5	17.3	5.3	3.0	7.9	1.3	0.5	2.3	27	27
				20+	4.7	0.3	10.7	1.7	0.0	4.7	0.7	0.0	1.3	6	6
			LowMid Elev-Moist	0-9.9	6.8	4.4	9.3	2.3	1.1	3.8	0.9	0.3	1.7	38	38
				10-19.9	17.1	14.2	20.2	5.5	4.3	6.8	1.7	1.2	2.3	105	105
				20+	10.3	6.2	14.9	6.4	3.7	9.6	4.7	2.7	7.0	14	14
			Subalpine	0-9.9	7.9	1.5	17.4	3.8	0.5	8.0	0.5	0.0	1.8	13	13
				10-19.9	12.2	7.5	17.7	2.2	1.1	3.6	0.5	0.2	0.9	32	32
				20+	18.1	12.0	24.1	18.1	12.0	24.1	12.0	6.0	18.1	1	1
		All	PICO	0-9.9	5.4	1.3	10.5	1.6	0.0	5.8	0.1	0.0	0.5	8	8
				10-19.9	20.3	6.4	35.5	1.4	0.0	3.8	0.6	0.0	1.5	7	7

Table 4a continued: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for each northern Idaho Forest.

Area	Wilderness /Roadless	Dominance Group	Final Habitat Type Group	NID Seral Group	Snags per Acre 10"+ Mean	Snags per Acre 10"+ 90% CI - Lower Bound	Snags per Acre 10"+ 90% CI - Upper Bound	Snags per Acre 15"+ Mean	Snags per Acre 15"+ 90% CI - Lower Bound	Snags per Acre 15"+ 90% CI - Upper Bound	Snags per Acre 20"+ Mean	Snags per Acre 20"+ 90% CI - Lower Bound	Snags per Acre 20"+ 90% CI - Upper Bound	Total Number PSUs	Number Forested PSUs
Clearwater NF	IN	Other	Dry	0-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8	8
				10-19.9	4.2	1.8	6.9	1.8	0.5	3.7	0.9	0.3	1.7	13	13
				20+	10.0	0.0	38.1	1.0	0.0	3.0	1.0	0.0	3.0	2	2
			LowMid Elev-Moist	0-9.9	1.5	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
				10-19.9	9.4	6.5	12.7	5.8	3.7	8.2	3.2	2.0	4.5	42	42
				20+	13.1	6.3	21.1	11.1	5.2	18.0	7.1	3.0	11.8	9	9
			Subalpine	0-9.9	7.5	3.1	12.7	1.5	0.3	3.0	0.2	0.0	0.5	18	18
				10-19.9	12.5	8.8	16.6	3.7	2.3	5.3	1.2	0.6	1.9	50	50
				20+	15.7	4.6	29.8	8.7	3.0	15.0	2.7	0.8	5.2	6	6
		PICO	All	0-9.9	1.9	0.2	4.0	1.0	0.0	2.6	0.1	0.0	0.3	13	13
				10-19.9	8.6	5.0	12.6	1.8	0.4	3.5	0.5	0.0	1.4	24	24
	OUT	Other	Dry	0-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
				10-19.9	6.0	0.0	13.4	2.0	0.0	4.8	1.0	0.0	2.6	6	6
				20+	7.0	1.0	13.8	5.5	1.0	11.0	4.0	0.7	9.0	4	4
			LowMid Elev-Moist	0-9.9	1.0	0.0	2.3	0.1	0.0	0.3	0.1	0.0	0.3	20	20
				10-19.9	13.9	10.1	17.9	6.2	4.2	8.4	2.8	1.5	4.3	41	41
				20+	10.3	4.9	17.5	7.5	3.8	12.1	3.4	1.9	5.0	15	15
			Subalpine	0-9.9	6.0	0.0	18.1	0.0	0.0	0.0	0.0	0.0	0.0	3	3
				10-19.9	16.7	6.9	28.2	6.0	1.8	11.2	1.9	0.4	4.3	9	9
				20+	3.7	0.7	8.8	1.7	0.5	3.0	1.7	0.5	3.0	3	3
		PICO	All	10-19.9	10.7	2.6	19.1	2.7	0.0	8.0	2.7	0.0	7.8	3	3

Table 4a continued: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for each northern Idaho Forest.

Area	Wilderness /Roadless	Dominance Group	Final Habitat Type Group	NID Seral Group	Snags per Acre 10"+ Mean	Snags per Acre 10"+ 90% CI - Lower Bound	Snags per Acre 10"+ 90% CI - Upper Bound	Snags per Acre 15"+ Mean	Snags per Acre 15"+ 90% CI - Lower Bound	Snags per Acre 15"+ 90% CI - Upper Bound	Snags per Acre 20"+ Mean	Snags per Acre 20"+ 90% CI - Lower Bound	Snags per Acre 20"+ 90% CI - Upper Bound	Total Number PSUs	Number Forested PSUs
Nez Perce NF	IN	Other	Dry	0-9.9	4.6	0.0	12.7	3.0	0.0	7.9	0.8	0.0	2.6	11	11
				10-19.9	9.6	6.1	13.5	4.2	2.1	6.8	1.6	0.7	2.8	30	30
				20+	6.8	3.4	11.5	3.8	2.2	5.7	2.2	1.2	3.4	22	22
			LowMid Elev-Moist	0-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
				10-19.9	11.8	6.5	17.9	4.9	1.9	8.3	2.6	0.9	4.7	19	19
				20+	11.0	5.1	17.9	8.3	3.7	13.8	3.4	2.0	5.0	11	11
			Subalpine	0-9.9	19.8	12.2	28.5	5.4	2.3	9.6	1.1	0.4	2.1	21	21
				10-19.9	18.4	13.7	23.4	4.6	2.7	6.8	1.8	0.8	3.0	42	42
				20+	5.5	2.3	9.4	4.8	1.6	8.6	2.5	1.0	4.7	8	8
		PICO	All	0-9.9	6.1	3.0	9.5	0.5	0.0	1.5	0.1	0.0	0.3	15	15
				10-19.9	7.5	2.4	13.9	2.5	0.5	5.1	0.5	0.0	1.4	12	12
	OUT	Other	Dry	0-9.9	4.3	0.0	9.4	1.7	0.0	6.0	0.6	0.0	2.0	7	7
				10-19.9	14.5	8.7	21.1	6.5	3.0	10.5	2.3	0.9	4.0	27	27
				20+	8.7	0.6	20.2	5.3	0.3	14.5	2.7	0.3	6.4	7	7
			LowMid Elev-Moist	0-9.9	2.6	0.0	6.6	0.9	0.0	3.0	0.0	0.0	0.0	7	7
				10-19.9	15.9	8.1	25.0	6.7	2.5	12.2	2.3	1.1	3.8	19	19
				20+	10.1	6.4	14.3	6.5	4.1	9.2	3.7	2.3	5.1	15	15
			Subalpine	0-9.9	6.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
				10-19.9	9.4	3.6	16.1	1.6	0.0	3.9	1.6	0.0	3.9	10	10
				20+	27.1	15.5	38.1	15.0	6.0	24.6	2.0	1.0	3.0	1	1
		PICO	All	0-9.9	13.2	2.7	28.7	0.1	0.0	0.3	0.1	0.0	0.3	11	11
				10-19.9	1.5	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4

Table 4b: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for each northern Idaho Forest.

Area	Wilderness/Roadless	Dominance Group	Final Habitat Type Group	NID Seral Group	Snags per Acre 10"+ Mean	Snags per Acre 10"+ 90% CI - Lower Bound	Snags per Acre 10"+ 90% CI - Upper Bound	Snags per Acre 15"+ Mean	Snags per Acre 15"+ 90% CI - Lower Bound	Snags per Acre 15"+ 90% CI - Upper Bound	Snags per Acre 20"+ Mean	Snags per Acre 20"+ 90% CI - Lower Bound	Snags per Acre 20"+ 90% CI - Upper Bound	Total Number PSUs	Number Forested PSUs
Idaho Panhandle NF	IN	Other	Dry	0-9.9	9.3	0.0	22.1	3.3	0.0	8.4	0.3	0.0	1.0	4	4
				10-19.9	61.7	35.7	89.9	25.5	11.5	41.4	5.0	1.7	9.6	10	10
				20+	33.1	11.0	58.1	15.0	8.0	22.0	9.0	4.0	13.0	1	1
			LowMid Elev-Moist	0-9.9	45.0	25.6	66.2	4.0	1.2	7.3	1.3	0.0	3.2	11	11
				10-19.9	61.4	51.1	72.0	25.3	19.4	31.4	7.5	4.7	10.7	34	34
				20+	70.1	51.3	91.6	46.9	35.6	58.8	29.1	20.6	37.6	8	8
			Subalpine	0-9.9	28.4	10.0	49.3	1.9	0.0	4.8	0.1	0.0	0.4	10	10
				10-19.9	69.2	56.9	82.5	24.1	18.7	29.7	6.5	3.8	9.7	34	34
				20+	65.8	30.7	103.5	44.1	17.4	73.1	24.8	9.0	44.7	5	5
		All	PICO	0-9.9	24.1	13.4	36.9	2.3	0.0	6.0	0.0	0.0	0.0	8	8
				10-19.9	57.8	38.4	78.1	14.9	8.3	22.8	2.1	0.0	6.1	8	8
	OUT	Other	Dry	0-9.9	18.9	6.0	33.8	2.9	0.1	6.4	0.2	0.0	0.6	9	9
				10-19.9	65.1	50.8	80.6	26.2	19.3	33.8	7.0	5.0	9.2	27	27
				20+	22.2	12.3	33.8	16.4	9.3	24.2	11.2	7.1	15.7	6	6
			LowMid Elev-Moist	0-9.9	29.7	20.5	39.5	3.9	2.0	6.0	0.4	0.1	0.8	38	38
				10-19.9	76.0	68.5	83.6	31.0	27.5	34.7	8.8	7.3	10.4	105	105
				20+	70.1	53.2	87.6	44.1	33.5	55.2	25.7	20.0	31.5	14	14
			Subalpine	0-9.9	29.5	11.6	50.7	3.6	0.9	6.8	1.3	0.1	3.0	13	13
				10-19.9	74.1	61.5	87.2	29.4	21.6	37.8	7.4	4.8	10.1	32	32
				20+	24.1	12.0	36.1	24.1	12.0	36.1	6.0	0.0	12.0	1	1
		All	PICO	0-9.9	28.6	12.8	46.4	1.5	0.0	4.0	0.0	0.0	0.0	8	8
				10-19.9	67.8	48.3	89.3	11.9	6.2	18.1	0.7	0.0	1.7	7	7

Table 4b continued: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for each northern Idaho Forest.

Area	Wilderness /Roadless	Dominance Group	Final Habitat Type Group	NID Seral Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
					Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Clearwater NF	IN	Other	Dry	0-9.9	1.6	0.0	4.5	0.1	0.0	0.5	0.1	0.0	0.5	8	8
				10-19.9	79.0	50.9	108.9	28.0	16.2	41.8	8.5	4.1	14.1	13	13
				20+	26.0	4.0	45.1	23.0	3.5	38.0	17.0	3.0	32.5	2	2
			LowMid Elev-Moist	0-9.9	25.6	0.0	66.2	1.5	0.0	6.0	0.0	0.0	0.0	4	4
				10-19.9	75.5	62.2	89.3	31.1	24.9	37.7	11.5	8.6	14.7	42	42
				20+	48.8	31.1	67.1	32.5	19.9	46.4	20.7	14.0	28.0	9	9
			Subalpine	0-9.9	23.9	13.1	35.9	1.8	0.3	3.9	0.2	0.0	0.4	18	18
				10-19.9	78.0	67.1	89.0	24.9	20.3	29.8	7.9	5.9	10.3	50	50
				20+	47.3	18.4	79.2	35.2	14.0	59.2	26.2	7.3	48.3	6	6
		PICO	All	0-9.9	38.0	23.4	54.2	1.9	0.0	3.9	0.0	0.0	0.0	13	13
				10-19.9	66.9	50.5	84.0	16.0	10.6	21.8	1.3	0.6	2.4	24	24
	OUT	Other	Dry	0-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
				10-19.9	59.5	32.7	90.3	20.9	10.0	32.6	2.8	0.8	5.2	6	6
				20+	36.3	18.0	55.7	22.8	10.5	38.1	10.5	4.0	18.0	4	4
			LowMid Elev-Moist	0-9.9	13.3	6.0	22.1	1.3	0.0	3.2	0.1	0.0	0.3	20	20
				10-19.9	81.0	69.4	92.7	30.2	24.8	36.0	10.0	7.4	12.8	41	41
				20+	53.2	39.1	67.6	39.0	29.4	49.0	25.1	19.5	30.7	15	15
			Subalpine	0-9.9	20.1	9.0	33.1	2.0	0.0	6.0	0.0	0.0	0.0	3	3
				10-19.9	66.3	42.2	91.1	24.7	13.4	36.7	5.8	1.9	10.3	9	9
				20+	20.4	11.0	33.1	16.0	8.0	27.2	10.0	6.0	14.0	3	3
		PICO	All	10-19.9	41.5	7.0	74.2	7.4	1.5	13.4	1.3	0.0	3.0	3	3

Table 4b continued: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for each northern Idaho Forest.

Area	Wilderness /Roadless	Dominance Group	Final Habitat Type Group	NID Seral Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
					Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Nez Perce NF	IN	Other	Dry	0-9.9	14.9	2.1	32.3	1.7	0.2	4.3	0.6	0.1	1.2	11	11
				10-19.9	58.4	45.7	72.1	26.0	18.9	33.7	8.4	5.7	11.3	30	30
				20+	37.1	26.7	48.3	26.1	18.8	33.9	17.0	12.6	21.7	22	22
			LowMid Elev-Moist	0-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
				10-19.9	74.5	57.6	92.3	36.7	28.7	45.0	11.2	7.8	15.1	19	19
				20+	70.2	47.2	96.9	40.1	27.4	54.3	22.9	16.8	29.2	11	11
			Subalpine	0-9.9	27.7	16.8	39.5	2.8	0.8	5.2	0.8	0.1	1.8	21	21
				10-19.9	62.8	52.9	73.0	18.5	14.2	23.2	5.5	3.8	7.3	42	42
				20+	39.3	23.2	55.6	25.7	14.0	38.1	14.3	8.0	20.8	8	8
		PICO	All	0-9.9	39.3	26.7	52.3	1.6	0.0	3.7	0.4	0.0	1.5	15	15
				10-19.9	82.0	59.9	104.1	11.8	4.3	21.4	2.0	0.3	4.1	12	12
	OUT	Other	Dry	0-9.9	16.5	0.4	39.0	1.0	0.0	3.3	0.1	0.0	0.5	7	7
				10-19.9	62.3	49.9	75.1	23.4	18.5	28.6	8.9	6.1	12.0	27	27
				20+	36.6	18.8	55.8	25.5	14.5	36.4	16.0	9.0	23.1	7	7
			LowMid Elev-Moist	0-9.9	14.6	3.0	28.9	0.0	0.0	0.0	0.0	0.0	0.0	7	7
				10-19.9	86.9	63.7	110.9	40.7	29.1	52.8	16.1	11.4	21.2	19	19
				20+	71.7	54.9	88.5	47.7	35.3	60.1	29.7	22.8	36.9	15	15
			Subalpine	0-9.9	15.5	4.3	26.6	2.0	0.0	6.0	0.5	0.0	2.0	4	4
				10-19.9	66.7	43.6	90.5	19.6	10.6	29.7	7.5	3.9	11.6	10	10
				20+	76.1	60.1	92.2	55.1	33.0	78.1	25.0	21.0	30.0	1	1
		PICO	All	0-9.9	35.6	18.9	53.4	0.5	0.0	2.0	0.0	0.0	0.0	11	11
				10-19.9	104.0	51.6	164.0	13.8	3.0	25.6	3.3	1.0	5.5	4	4

Table 5: Snag densities for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups, for nothern Idaho Forests and for each Forest. Note: this table shows mean snag densities for the *entire* Forest.

Area	Dominance Group	Final Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
North Idaho	Other	Dry	8.4	6.9	10.0	3.8	2.9	4.7	1.5	1.1	1.9	199	199
	Other	LowMid Elev-Moist	11.9	10.6	13.2	5.1	4.5	5.8	2.3	1.9	2.6	415	415
	Other	Subalpine	12.8	11.2	14.6	3.7	3.0	4.4	1.2	0.9	1.5	282	282
	PICO	All	7.8	5.8	10.0	1.4	0.8	2.0	0.4	0.2	0.7	115	115
Idaho Panhandle	Other	Dry	9.4	6.9	12.1	3.9	2.5	5.5	1.1	0.6	1.7	58	58
	Other	LowMid Elev-Moist	13.5	11.6	15.4	4.7	3.9	5.5	1.9	1.5	2.3	211	211
	Other	Subalpine	11.2	8.7	14.0	3.3	2.3	4.4	1.1	0.6	1.6	100	100
	PICO	All	9.0	4.8	13.9	1.7	0.6	3.2	0.5	0.1	1.0	33	33
Clearwater	Other	Dry	4.0	2.1	6.1	1.7	0.8	2.8	1.0	0.5	1.8	35	35
	Other	LowMid Elev-Moist	9.6	7.8	11.5	5.4	4.3	6.7	2.8	2.1	3.5	132	132
	Other	Subalpine	11.4	8.8	14.2	3.4	2.4	4.5	1.1	0.7	1.5	94	94
	PICO	All	6.6	4.1	9.3	1.6	0.6	2.8	0.6	0.1	1.2	40	40
Nez Perce	Other	Dry	9.3	7.0	11.7	4.5	3.1	5.9	1.8	1.2	2.5	106	106
	Other	LowMid Elev-Moist	11.3	8.5	14.5	5.7	4.0	7.7	2.6	1.9	3.3	72	72
	Other	Subalpine	16.2	13.0	19.6	4.4	3.0	5.8	1.5	1.0	2.2	88	88
	PICO	All	7.9	4.4	12.4	0.9	0.2	1.7	0.2	0.0	0.5	42	42

Appendix D: Dominance groups used in Snag Estimates

Following is documentation on how the Dominance groups of PICO and Non-PICO, used in deriving estimates for snag density were derived from Dom Group 60_40. Dom Group 60_40 is a mid-level dominance group based off of the R1 Existing Vegetation Classification System of dominance type 60_40. Dom Group 60_40 is the same classification used when updating R1-VMap for northern Idaho Forests. For further information on how dominance type 60_40 is classified from inventory data, see *The Region One Vegetation Classification System and its Relationship to Inventory Data and the Region1 Existing Vegetation Map Products* (Barber and others, 2009). This dominance group is available through various reports supported by Region 1 and available through the R1 Report Depot (http://fsweb.r1.fs.fed.us/forest/inv/fsveg/index.htm).

DOM_GRP_6040_INV	Snag Analysis Dominance Group
ABGR	All Other Groups
ABGR-IMIX	All Other Groups
ABGR-TMIX	All Other Groups
ABLA	All Other Groups
ABLA-IMIX	All Other Groups
ABLA-TMIX	All Other Groups
BEPA	All Other Groups
CELE3	All Other Groups
IMIX	All Other Groups
JUNIP	All Other Groups
JUNIP-IMIX	All Other Groups
LALY	All Other Groups
LALY-IMIX	All Other Groups
LALY-TMIX	All Other Groups
LAOC	All Other Groups
LAOC-IMIX	All Other Groups
LAOC-TMIX	All Other Groups
none	All Other Groups
PIAL	All Other Groups
PIAL-IMIX	All Other Groups
PIAL-TMIX	All Other Groups
PICO	PICO
PICO-IMIX	PICO
PICO-TMIX	PICO

DOM_GRP_6040_INV	Snag Analysis Dominance Group
PIEN	All Other Groups
PIEN-HMIX	All Other Groups
PIEN-IMIX	All Other Groups
PIEN-TMIX	All Other Groups
PIFL2	All Other Groups
PIFL2-IMIX	All Other Groups
PIMO3	All Other Groups
PIMO3-IMIX	All Other Groups
PIMO3-TMIX	All Other Groups
PIPO	All Other Groups
PIPO-IMIX	All Other Groups
POPUL	All Other Groups
POTR5	All Other Groups
POTR5-HMIX	All Other Groups
PSME	All Other Groups
PSME-IMIX	All Other Groups
PSME-TMIX	All Other Groups
THPL	All Other Groups
THPL-IMIX	All Other Groups
THPL-TMIX	All Other Groups
TMIX	All Other Groups
TSHE	All Other Groups
TSHE-TMIX	All Other Groups
TSME	All Other Groups
TSME-TMIX	All Other Groups

Appendix E: Regional Disturbance Statistics for 2000-2007 and Harvest Acres from 1950-2007

Report compiled May 20, 2008

Average harvest acres 2000-2007 (FACTS)

- The Region has harvested approximately 24,312 acres per year**,** over the past 8 years.
- 12% even-aged (5% of even-aged is clearcutting), 26% 2-aged, 3% selection harvest, and 59% intermediate harvest (commercial thinning, etc.)
- Statistics do not include pre-commercial thinning

Average Pre-Commercial Thinning and Release acres 2000-2007 (FACTS):

- The Region has pre-commercially thinned and released approximately 10,269 acres per year.

Average prescribed burning 2000-2007 (NFPORS):

- Over the past 8years approximately 44,000 acres of prescribed burning has been completed on the average each year.

Average number of acres burned in wildfire/fire use 2000-2007 (fire history layer):

- Approximately **273,000 acres/**year are burned on National Forest Systems land in Region 1.
- In 2007, for the fires over 1,000 acres, 35% of the acres were low severity, 15% of the acres were mixed severity, and 50% of the acres were high severity (from RAVG 2007).

Average number of acres with bark beetle mortality 2000-2007 (I and D detection flights):

- At least 625,000 acres/year or about 5 million acres in total have some form of mortality due to bark beetles.
- Some of these areas were visited multiple years by beetles. When multiple year mortality is included for the same acres, the total cumulative acres with beetle mortality is 12 million acres or 1.5 million acres a year. Therefore, over the eight years, the *severity* of infestation on the 5 million base acres affected, increases as the infestation progresses through time.

Information Sources:
FACTS: Forest Service Activity Tracking System, which records tabular information in an electronic database, and records, associated spatial polygons in a GIS system, for activities accomplished on an annual basis. This system houses the information for annual accomplishments reports for Congress as an accountability measure related to Forest Service budget allocations in areas of silvicultural practices, such as planting, thinning, timber harvest, and fuels activities by fund code. It also includes noxious weed treatment accomplishments and many other activities funded by KV dollars contained in Sale Area Betterment Plans.

NFPORS: National Fire Plan Operations Reporting System is an interagency fuels treatment accomplishment data base that is interagency by design that was developed to report to congress on fuels accomplishments on an annual basis. The Forest Service's fuels activities are loaded into FACTS then electronically moved into NFPORS as part of the interagency system.

NFPORS does not contain spatial information but does contain latitude and longitude, which locates the center of a project accomplishment on a map.

Fire History Layer: is a Region 1 spatial database, which has a polygon layer of fire perimeters gathered from incident command teams for each fire, by fiscal year.

Aerial Detection Survey: Flights completed each year across the northern Region to document the outbreaks of various insect infestations. The region is flown in a grid and insect and disease mortality is mapped through direct observation from the air. Not all areas of the region are flown every year and information is documented on areas flown and areas not observed. Weather and smoke are some factors related to areas not surveyed in a particular year. This map information is converted to GIS and can be used to track the progression of outbreaks over a time span.

RAVG: is a remote sensing product that is completed to determine fire severity for large fires over 1,000 acres each year. This is completed by the Remote Sensing Applications lab located in Salt Lake City, UT. This characterization of fire severity on vegetation is completed within 30 days of fire containment and can be used to determine some of the resource effects from the fires.